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The Journal of

THE ROYAL AERONAUTICAL SOCIETY

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LONDON
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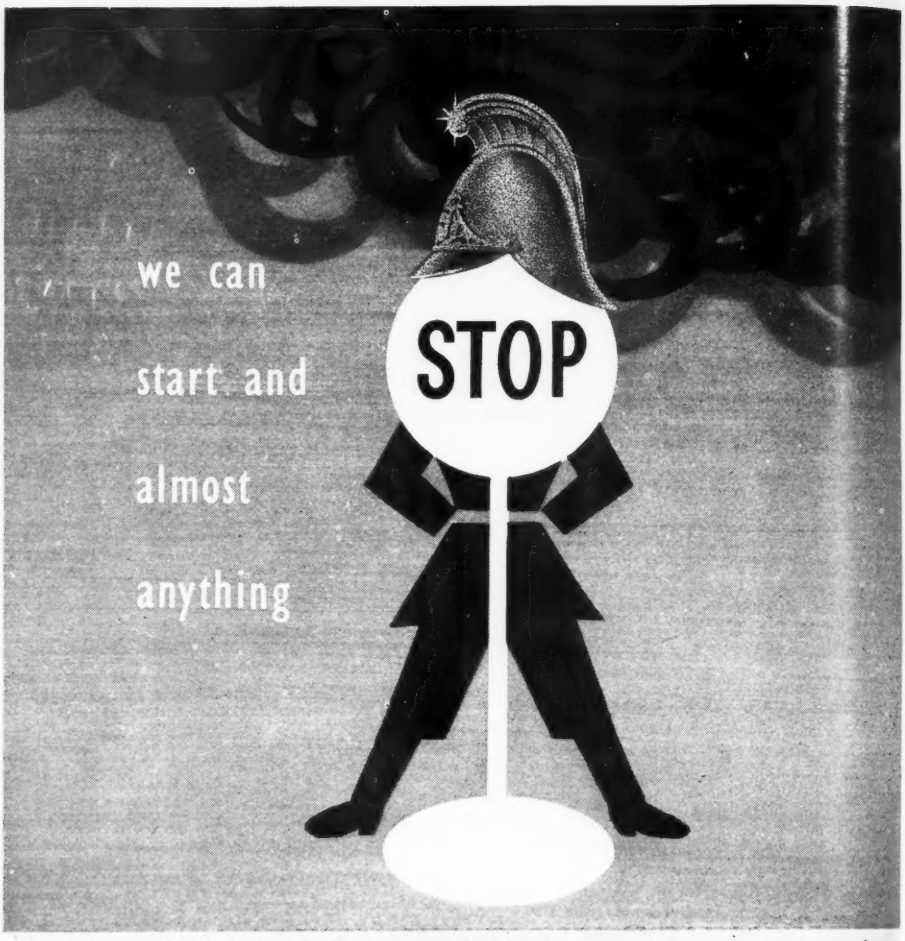

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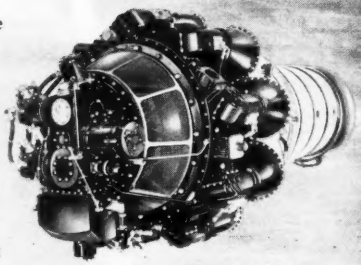

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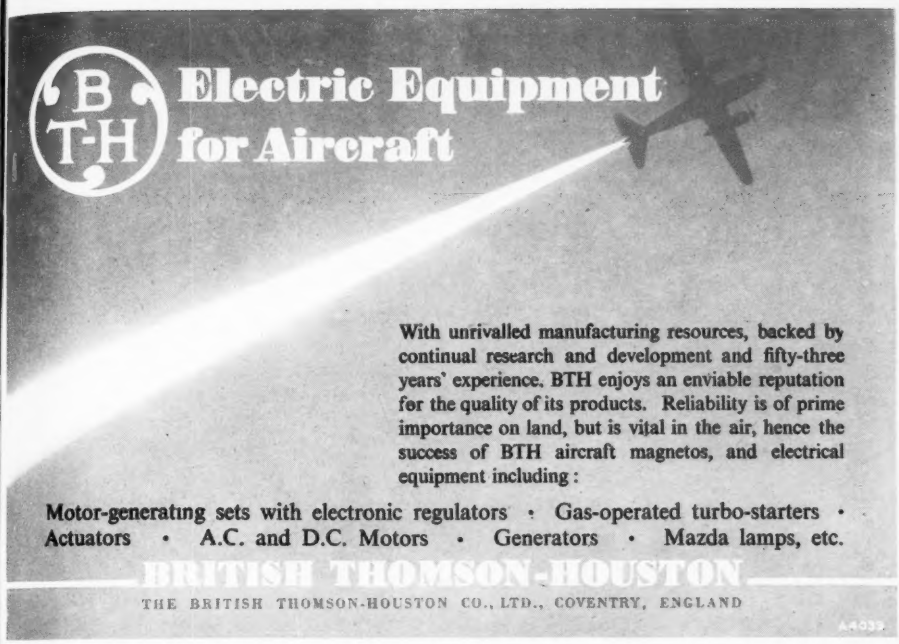
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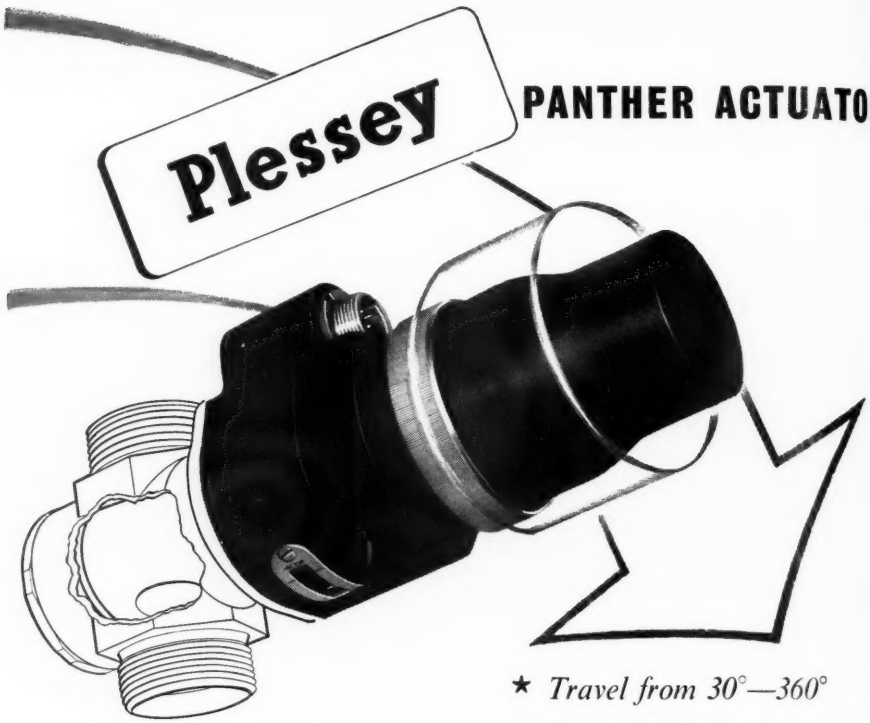

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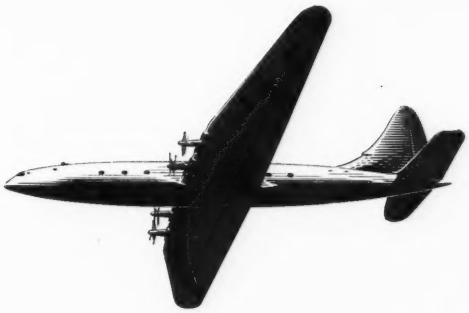

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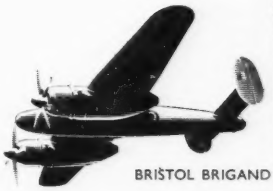

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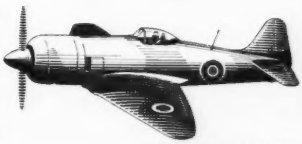

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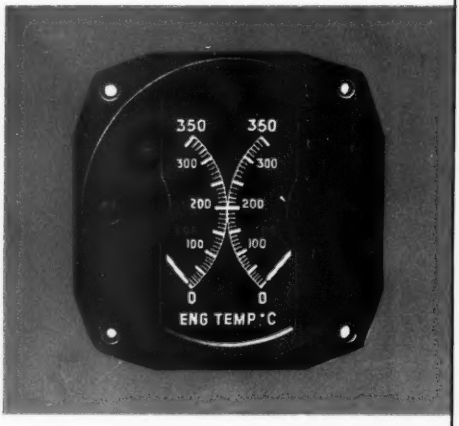

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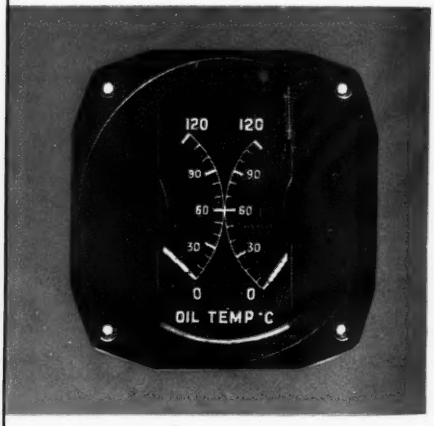

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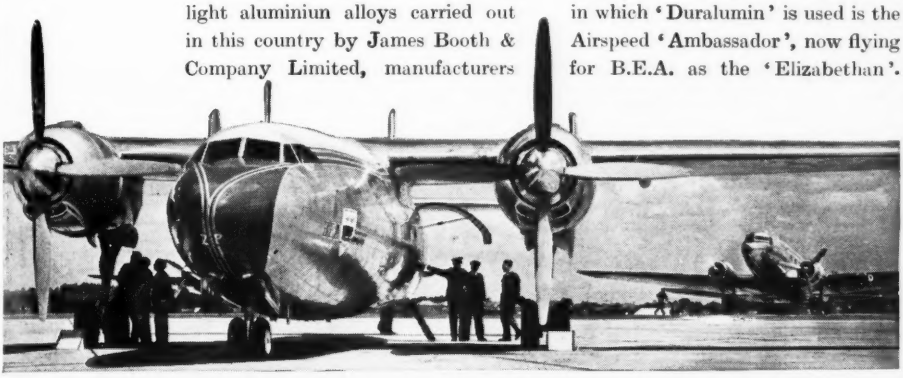

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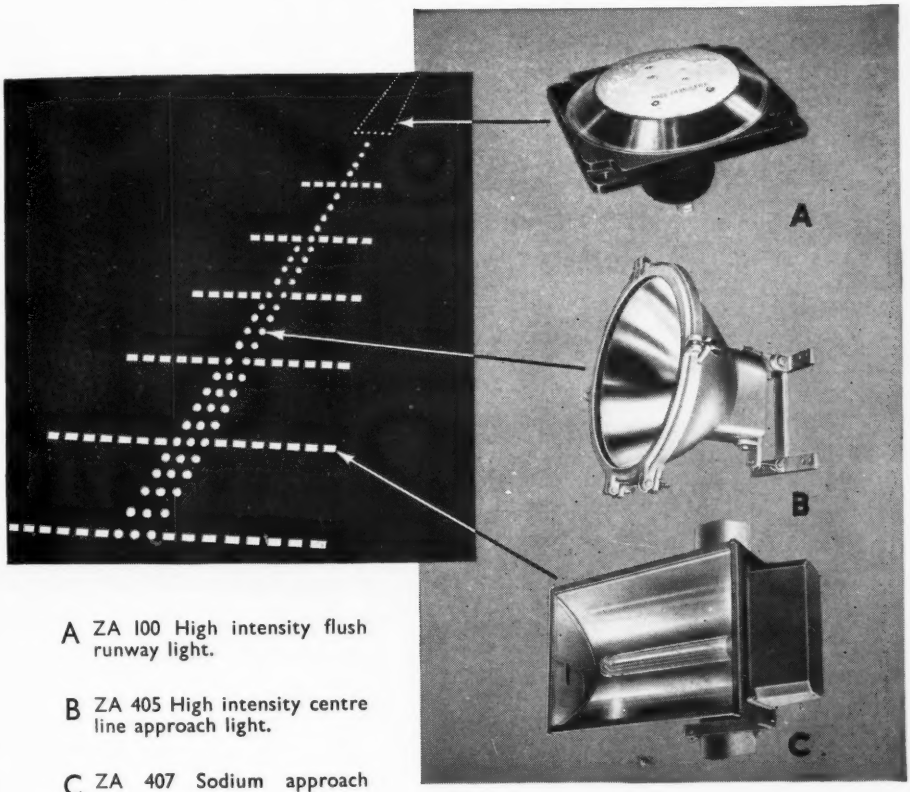

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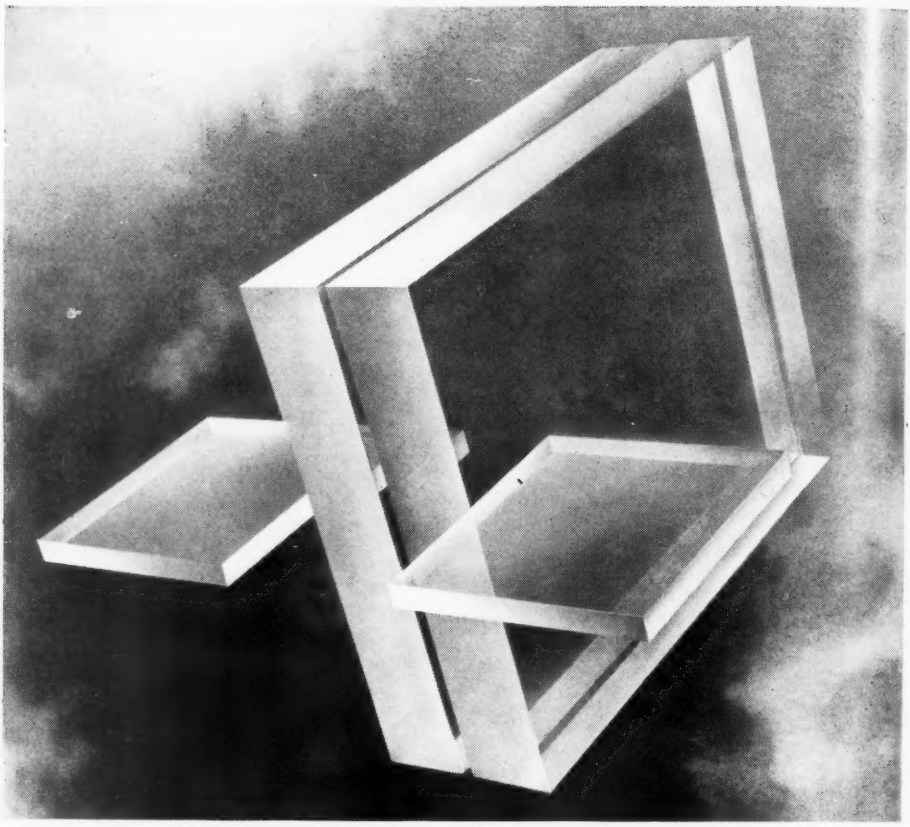

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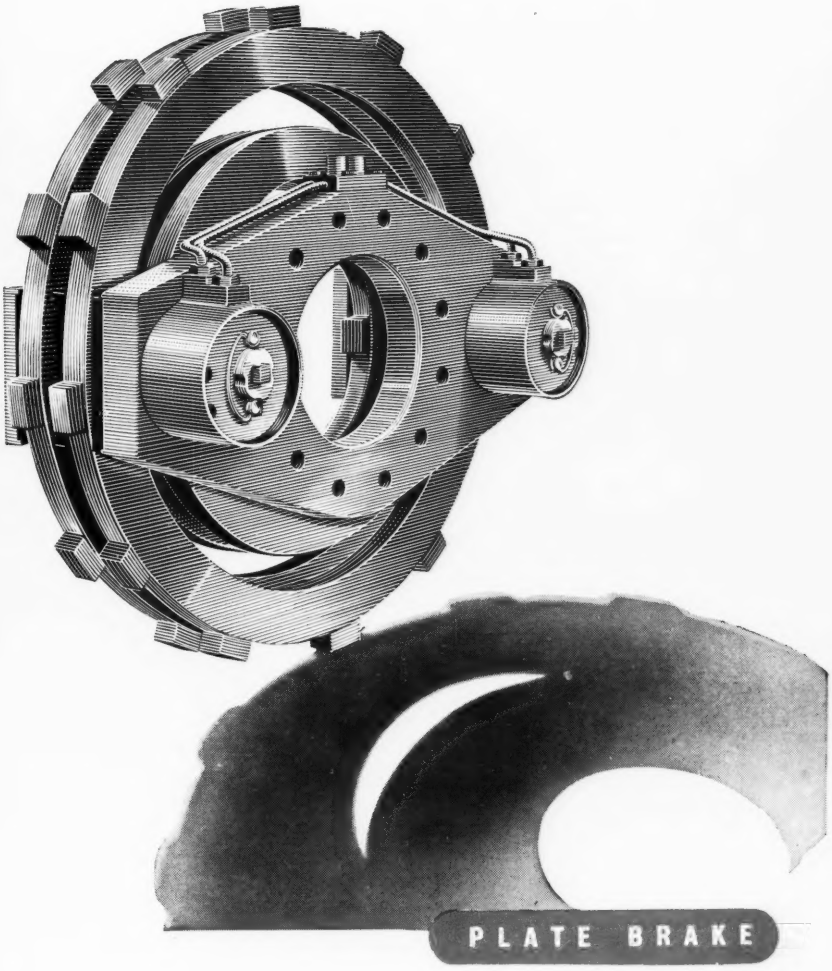

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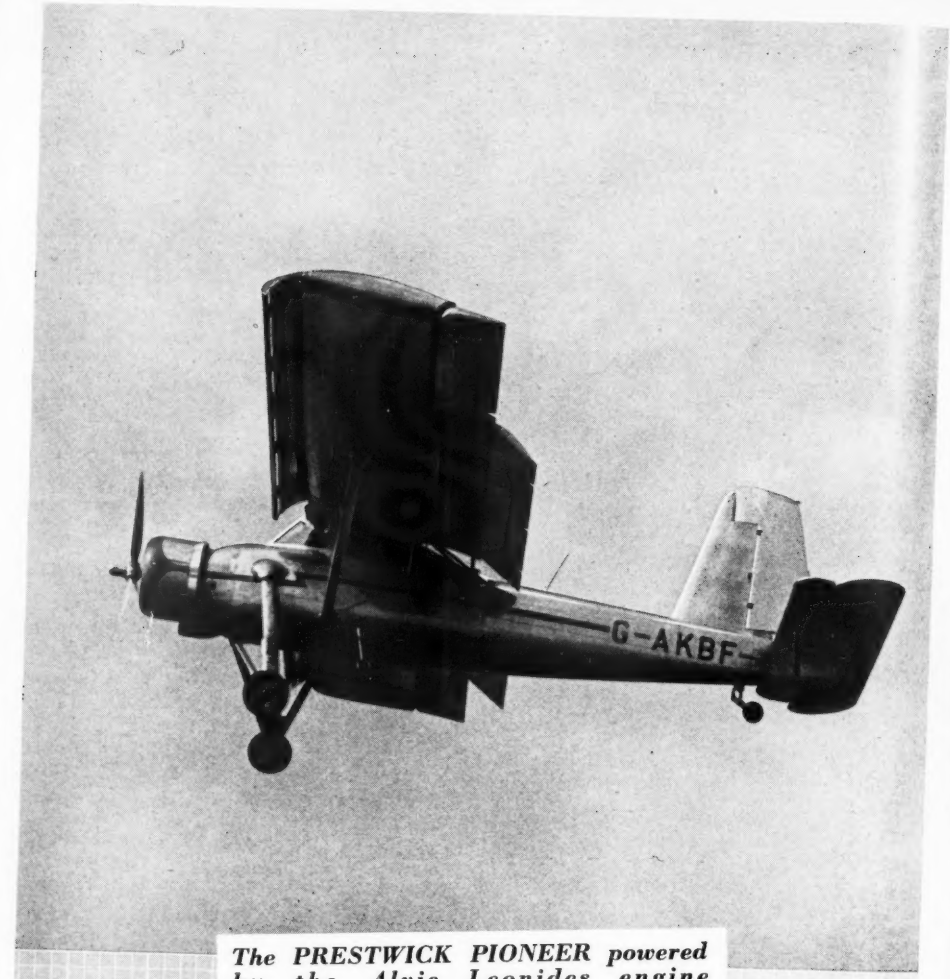

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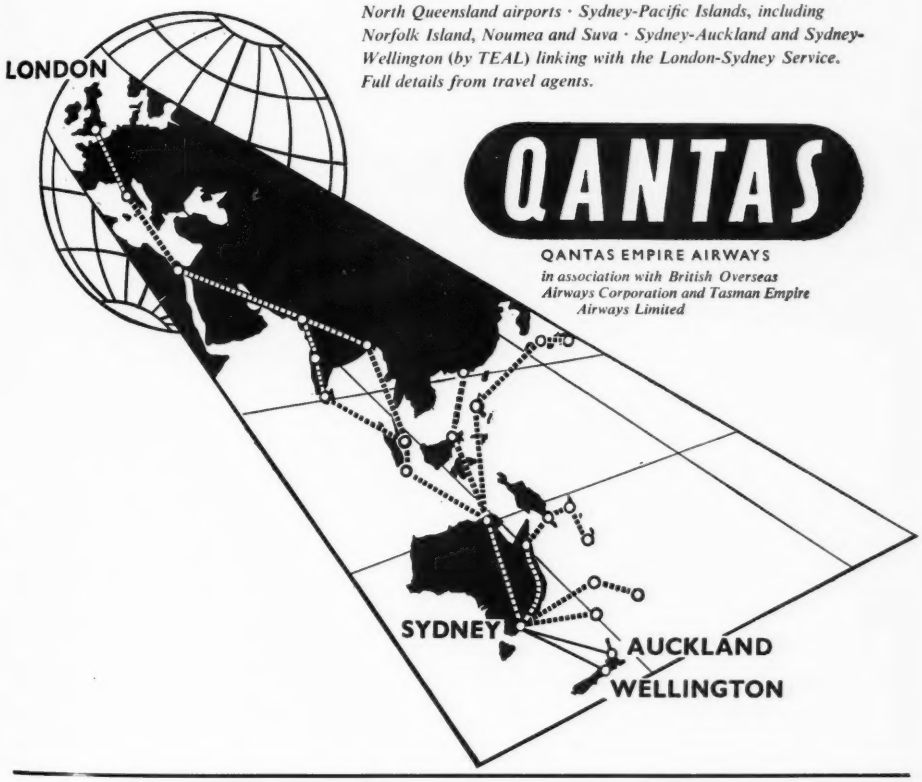

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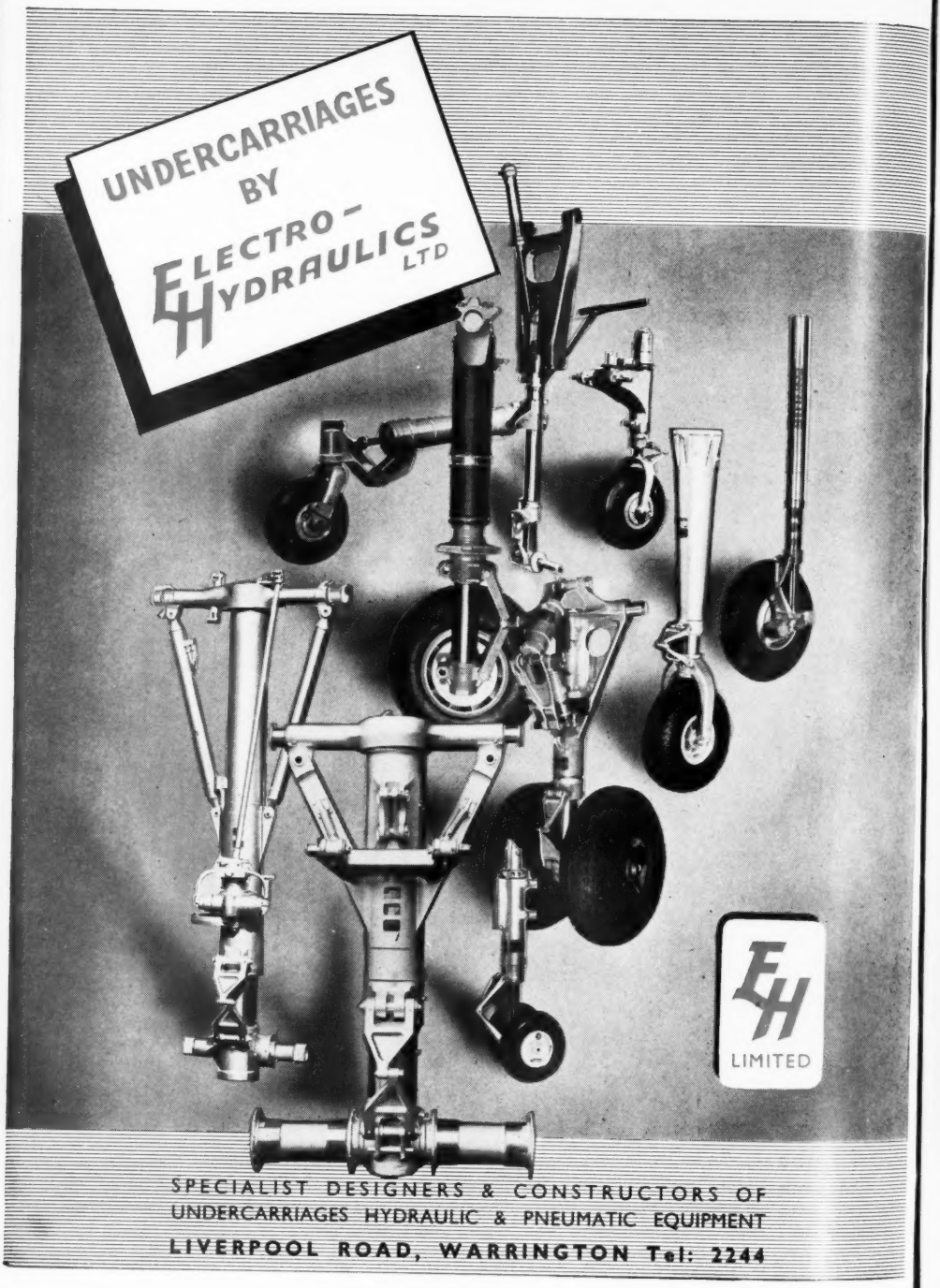
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Acceleration per Ampere...(a) Armature free 17.0g (b) With 2 lb load 2.1g
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Mountaineering in Metal

BROWSING along the non-friction shelves at the library the other day my eye caught the title, *A Plain Man's Guide to Lubrication.* I took the volume into a quiet corner and turned the pages. . . .

There was a photograph of either the Andes or the Rockies. Or was it the Alps? The high sierra, jagged peaks. I looked closer and read the legend—

"Steel surface ground with grade 150 carborundum. Height of irregularities about 3,000 to 10,000 Ångströms. Vertical magnification × 10,000."

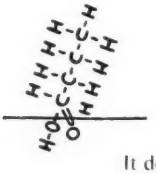
Well, you could have knocked me down with the proverbial. "An Ångström?" said the young lady at the counter. "An Ångström is one ten-thousandth of a micron or one hundred-millionth of a centimetre—why?"

"Oh, nothing," I said. "Silly of me to forget." I returned to my corner and read on.

Metal surfaces that appear perfectly smooth to the naked eye, the author revealed, are in reality extraordinarily rough. They are pitted and scored by deep valleys and traversed by chains of mountains with lofty peaks known as "asperities." Thus when two surfaces rub together a fair amount of friction is generated and the metal surfaces suffer wear and tear. (The experts speak of "plastic deformation," "elastic deformation," "local welding," "abrasion" and "molecular attraction," but they *mean* wear and tear—I think.)

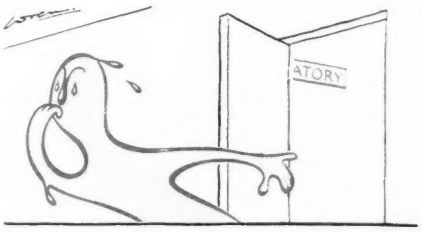
Now wear and tear, it seems, can be reduced by lubrication ("No, not for me, thanks, I'm driving"), by splash feed lubrication, force feed lubrication and full force feed lubrication—to blazes with technicalities: let's call it hydrodynamic or fluid film lubrication—all are achieved by using the best lubricants. Esso lubricants.

This little diagram will, perhaps, make everything crystal clear:



It does? Good.

Let's go back a bit. The engine used by the Wright brothers differed very little from the ordinary motor-car engine of the day, and the motor oil of the day was good enough to keep their biplane flying without a fatal dose of friction. But as aircraft engines improved in power and performance, as speeds and pressures and cylinder temperatures rocketed, lubrication outgrew its early infancy and entered the laboratories. Here it can be seen entering the laboratories:



Aircraft became larger, heavier, flew higher . . . 10,000 feet . . . 20,000 feet . . . 40,000 feet . . . and lubricants were required to flow readily at 0 deg. F. . . . –33 deg. . . . –67 deg. Esso supplied them.

Esso still supplies them. In the labs. scientists concoct complex chemical compounds known as "additives," substances which are (yes!) added to oils and greases to increase their efficiency. Some years ago they devised additive 'A' (let's call it) which prevents oil congealing in cold weather; then there was 'B' which helps oil carry the heavier loads imposed by increasingly powerful engines. 'C' prevents excessive thinning-out when hot, excessive thickening when cold. And then there are 'X' and 'Y' and 'Z.' And 'E' and 'S' and 'S' and 'O.' Yes—

It pays to say

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SUPERSONIC PROPELLERS*

by

Dr. W. F. HILTON

NOTATION

C_L, C_D	lift and drag coefficients of aerofoil section
n	propeller rotational speed (revolutions/sec.)
r	propeller radius
α	incidence of blade element to air flow
θ	geometrical incidence of blade element
ϕ	helix angle of propeller $[=\tan^{-1} V/(2\pi nr)]$
ϕ_1	value of ϕ giving maximum blade element efficiency
V	forward speed
V_0	free stream speed
t	thickness of section of blade element
c	chord of blade element
Q, T	torque and thrust, respectively, on blade element
L, D	lift and drag per unit length of propeller blade
M	Mach number
M_0	free stream Mach number
M_1	Mach number at entry
T_0, T_1, T_2, T_3, T_4	temperatures at positions shown in Fig. 7
p_1, p_2	pressures at entry and exit of compressor, respectively
a	speed of sound
A	area of entry duct
η	efficiency of blade element
η_T	thermal efficiency
C_p	specific heat of air at constant pressure
ρ	air density
J	mechanical equivalent of heat
g	acceleration due to gravity

*A paper based on a Section Lecture given before the Society on 30th October 1951.

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1. INTRODUCTION

A start is made by considering why the subsonic propeller was abandoned when aircraft speeds approached the shock stall. It is true that the shock stall also occurs on the propeller blades under these conditions, causing a loss of lift and an increase of drag, but this is not the predominant effect which produces the marked decrease of propeller efficiency associated with high-speed aircraft. The main aerodynamic difficulty associated with the shock stall on the wings of an aircraft is due to the separation of flow caused by the shock wave rather than the presence of the shock wave itself. This difficulty is reduced on a propeller, as any separation of flow which might occur on a propeller blade due to the shock stall, would tend to cause the air to be stagnant relative to the blade, and would thus experience a large centrifugal force by virtue of the propeller rotation. Thus the propeller shock stall would never develop to the same degree that it does on the wings of an aircraft in steady flight.

Although the term supersonic propeller is useful in defining the precise subject of this paper, the aerodynamics of supersonic *versus* subsonic flow play only a small part in determining the efficiency of the device. The theory of the supersonic propeller is in fact simpler than the subsonic propeller because an analytical form exists for the lift and drag coefficients of the separate blade sections and it is often possible to integrate thrust and torque along the blade by mathematical processes instead of by laborious calculation.

The predominant effect which caused the subsonic propeller to fall into disrepute for the propulsion of high-speed aircraft, was the very high blade angle which is necessary to keep the blade speeds below the speed of sound. For example, with a propeller having a tip speed of 1,000 ft./sec. and propelling the aircraft at 100 ft./sec., the blade tip will move through the air at helix 1/10 of a

radian, say 6°, and the lift and drag of the blade section will be inclined at 6° to the aircraft axes. This is illustrated in Fig. 1(*a*), which shows that nearly all of the lift force on the blade section is tending to pull the aircraft forward and only a very small component of the lift force is tilted backwards to oppose the torque of the engine. Naturally the drag force acts against the engine to almost its full value. At higher aircraft speeds the angle ϕ will have to be much greater, as is indicated in Fig. 1(*b*). The major aerodynamic force on a blade section is the lift force and while a considerable proportion of this is helping to provide thrust for the aircraft, it is clear that a large component of this lift force is now pulling against the engine in the torque direction. These high blade angles are avoided in a supersonic propeller. If the aircraft speed is also supersonic, it is possible to calculate the performance of the propeller in the manner given in Ref. 1. The supersonic forward speed simplifies the theory considerably as there is no longer need to take account of the induced air flow from the tip vortex system and while it is true that the supersonic propeller would have a very useful range of operation at high subsonic speeds, the exact theory for this case is not known to have been worked out.

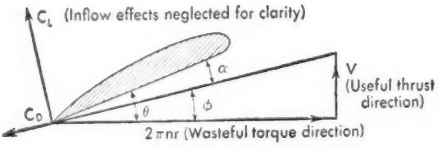

Fig. 1(*a*).
Velocity triangle for propeller-blade element at low forward speeds.

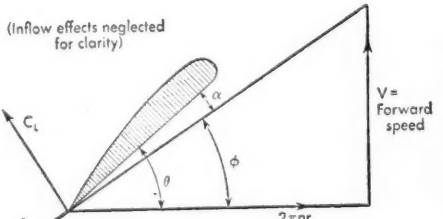

Fig. 1(*b*).
Velocity triangle for propeller-blade element at high forward speeds.

The exact expressions for thrust and torque are

$$\text{Torque} = \text{Lift} \times \sin\phi + \text{Drag} \times \cos\phi$$
$$\text{Thrust} = \text{Lift} \times \cos\phi - \text{Drag} \times \sin\phi.$$

The efficiency of the blade element is given exactly* by

$$\eta = \frac{V_0}{2\pi n}\frac{dT}{dQ} = \frac{V_0(L\cos\phi - D\sin\phi)}{2\pi nr(L\sin\phi + D\cos\phi)} = \frac{L/D - \tan\phi}{L/D + \cot\phi} \quad . \quad . \quad (1)$$

where L and D are the lift and drag per unit length.

Figure 2 includes some typical blade element efficiencies of subsonic, transonic and supersonic blade elements based on this exact equation. The superiority of the subsonic propeller at low speeds and of the supersonic propeller at aircraft Mach numbers above 0.8 is at once apparent.

The transonic propeller has little practical application and it is this fact which has prevented natural evolution from the all-subsonic to the all-supersonic propeller.

If the exact relation of equation (1) is differentiated with respect to ϕ, a value ϕ_1 giving maximum blade element efficiency can be found. This is shown in Ref. 1 to give the relation

$$(L/D)_{max} = \tan 2\phi_1 \quad . \quad . \quad (2)$$

Thus if $(L/D)_{max}$ has any value between 2.0 and infinity it is found that ϕ_1, the best value of ϕ, lies between 32° and 45°.

It can also be proved that the blade element efficiency under these conditions will be $\tan^2\phi_1$.

2. PROPELLER DESIGN

What would a supersonic propeller look like if it were to absorb say 10,000 h.p. and to be used to propel a supersonic multi-engined aircraft? In order to avoid detailed arguments as to the precise structural limitation of the supersonic propeller, the performance has been calculated of a propeller whose blades are of a substantial thickness ratio, tapering from 12 per cent. at the root to 5 per cent. at the tip, and it is expected that

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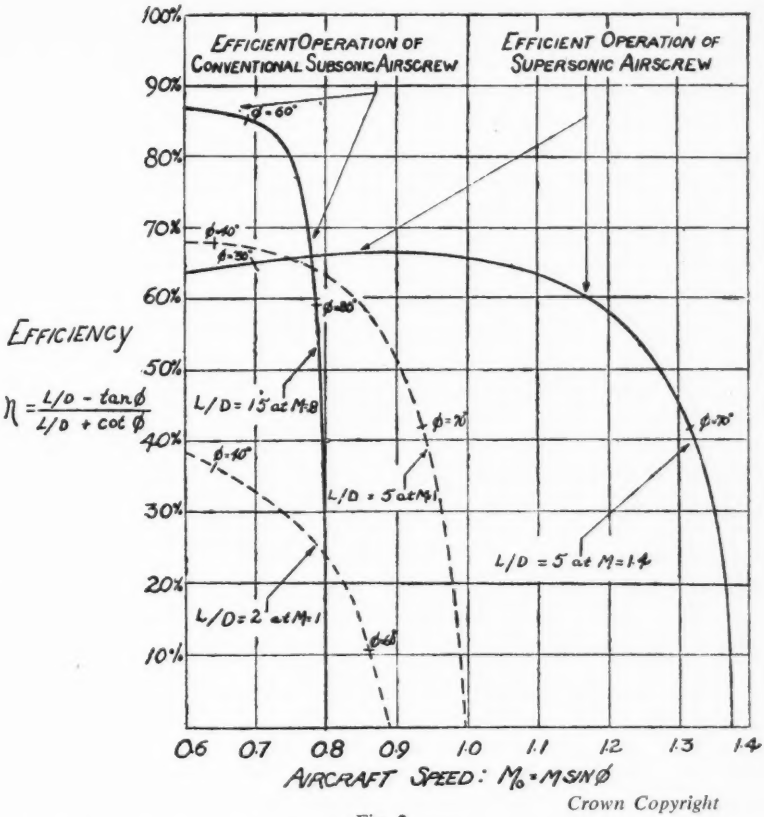

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Fig. 2.

Theoretical variation of blade element efficiency with forwadr speed M_0 and resultant speed M, showing the advantage of using higher M, even at the expense of L/D, for high values of M_0. This figure was drawn to show qualitatively why the supersonic propeller is superior to the subsonic propeller at high rates of advance. Each value of L/D gives a distinct curve, and realistic values of L/D were chosen for blade speeds $M = 0.8$, 1.0 and 1.4.

such a propeller could be considerably improved upon by any competent propeller designer.

It must be emphasised that if any saving of blade thickness could be made, it would reduce the supersonic drag force in proportion to the *square* of the thickness ratio and so a reasonably thin propeller design should achieve an efficiency of 80 per cent. compared with the 68 per cent. of the propellers shown in Figs. 3 to 6.

Considering these detailed designs which were first given in R. & M. 2345[1], it would be necessary to use a four-bladed propeller mounted on a hollow hub which would be the air intake for the engine driving the propeller; this unit would provide approximately 10,000 h.p. at supersonic velocities at sea level. There are many possible combinations of diameter, number of blades, blade width and twist, but examples other than those given may be worked out readily in each specific case.

Figure 4 shows a propeller design which will produce an efficiency of 68.3 per cent., for an aircraft having a Mach number of 1.1. Fig. 3 shows a similar propeller whose efficiency has been very slightly increased to 68.91 per cent. by increasing the chord near the blade tip. The propeller shown in Fig. 4

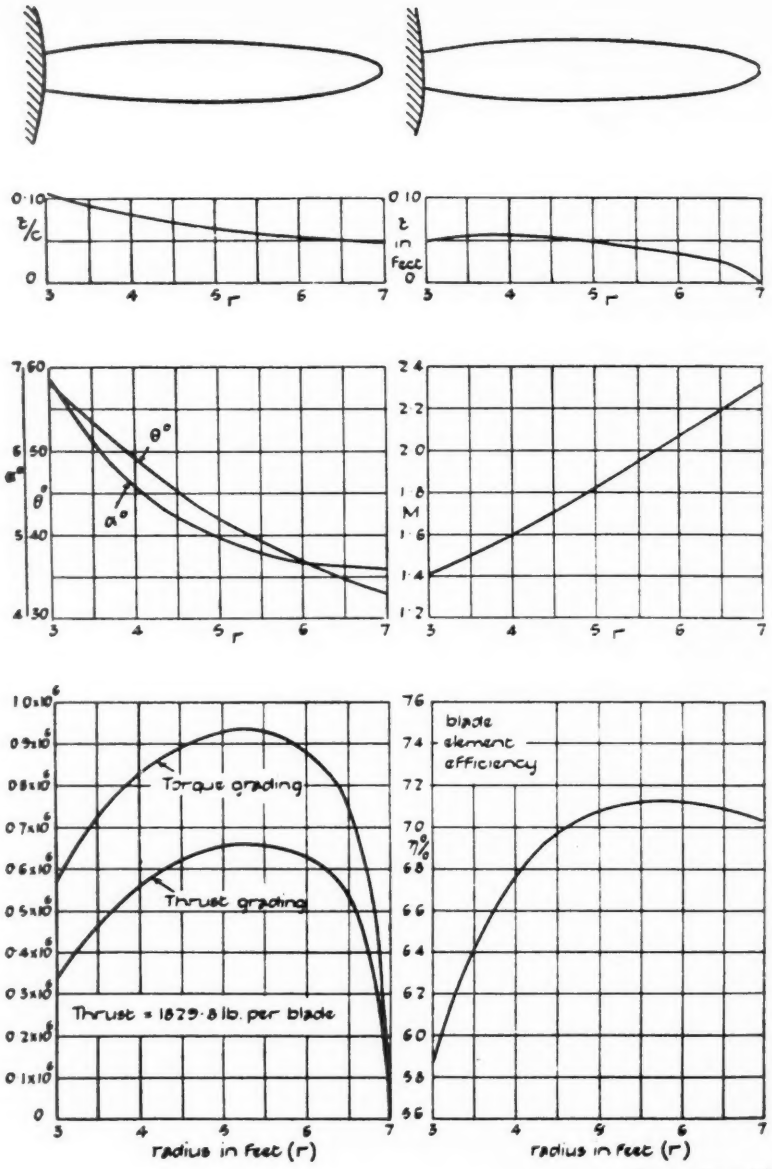

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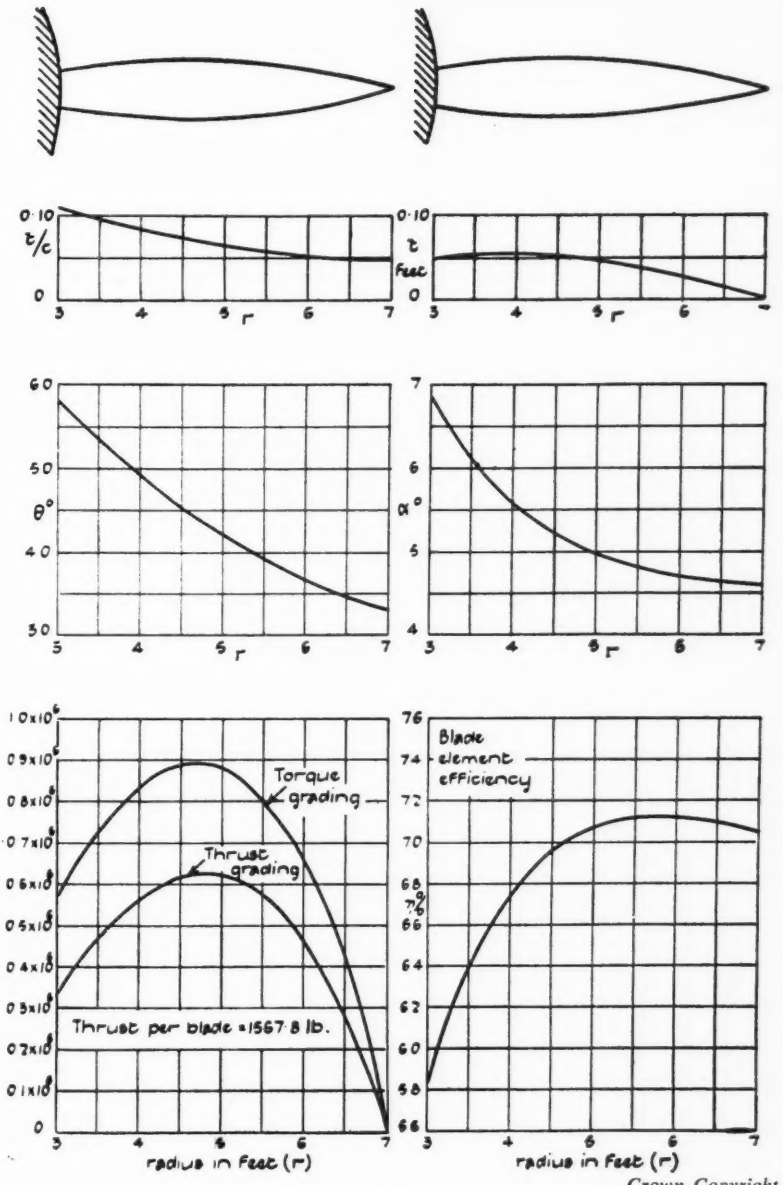
Fig. 3.
Airscrew I designed for a forward Mach number of 1.1 (847 m.p.h. at sea level).
Overall efficiency = 68.91 per cent., 3,058 r.p.m.



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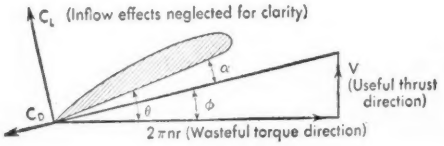

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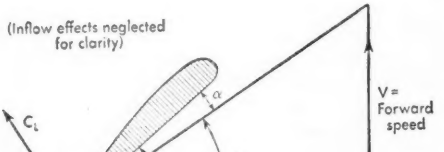

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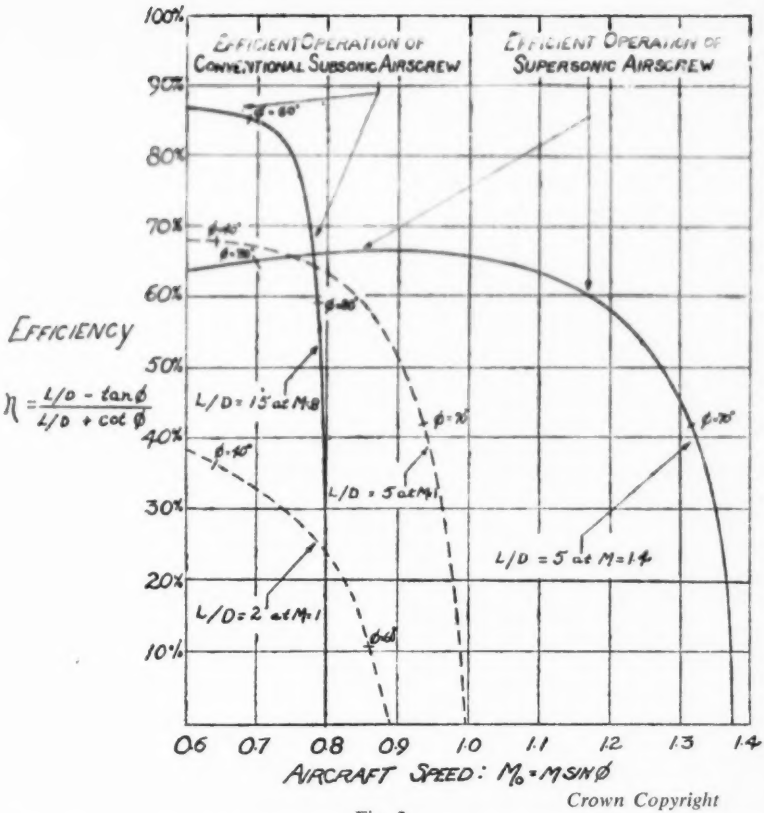

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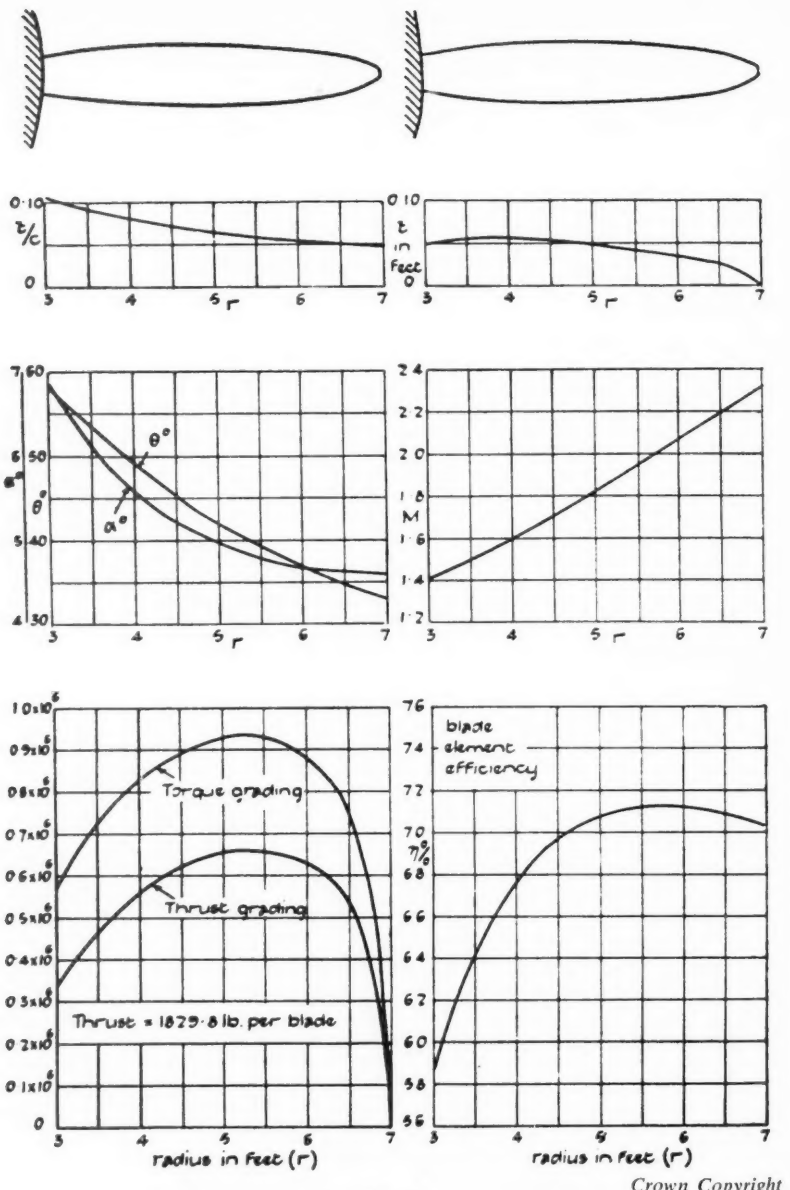

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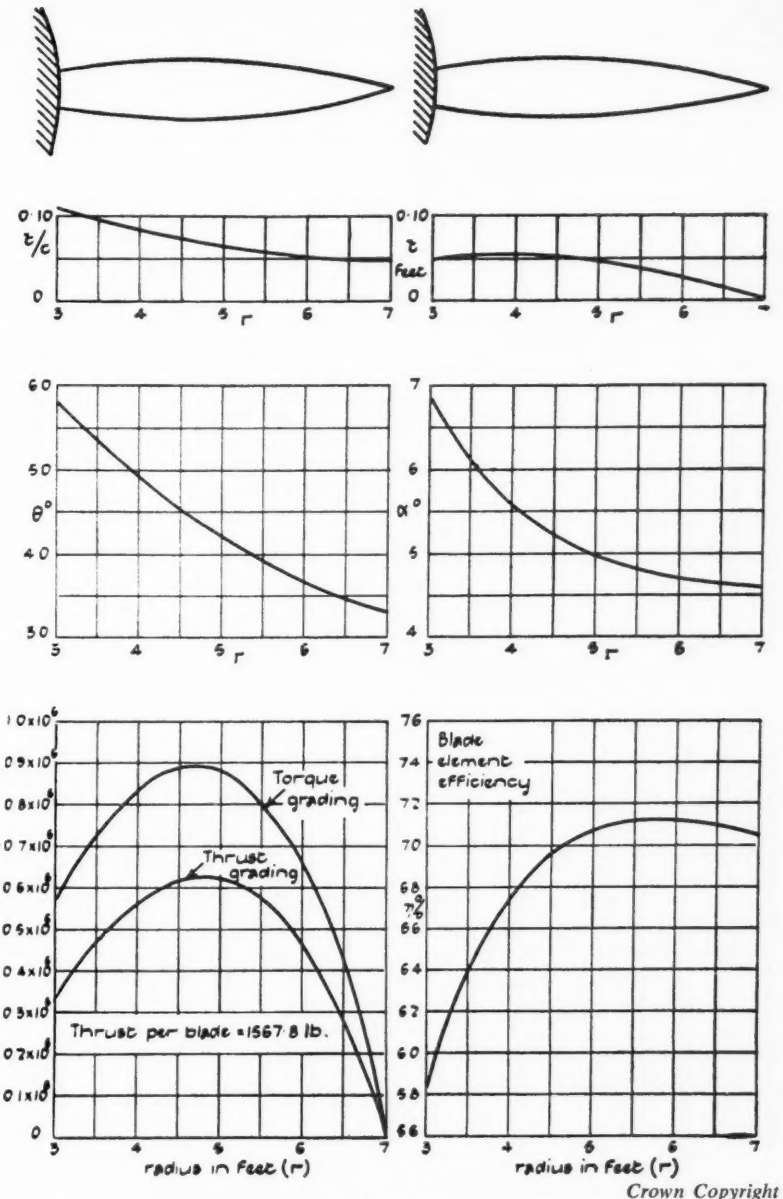
Fig. 3.
Airscrew I designed for a forward Mach number of 1.1 (847 m.p.h. at sea level).
Overall efficiency = 68.91 per cent., 3,058 r.p.m.



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Airscrew II designed for a forward Mach number of 1.1 (847 m.p.h. at sea level).
Overall efficiency = 68.63 per cent., 3,058 r.p.m.

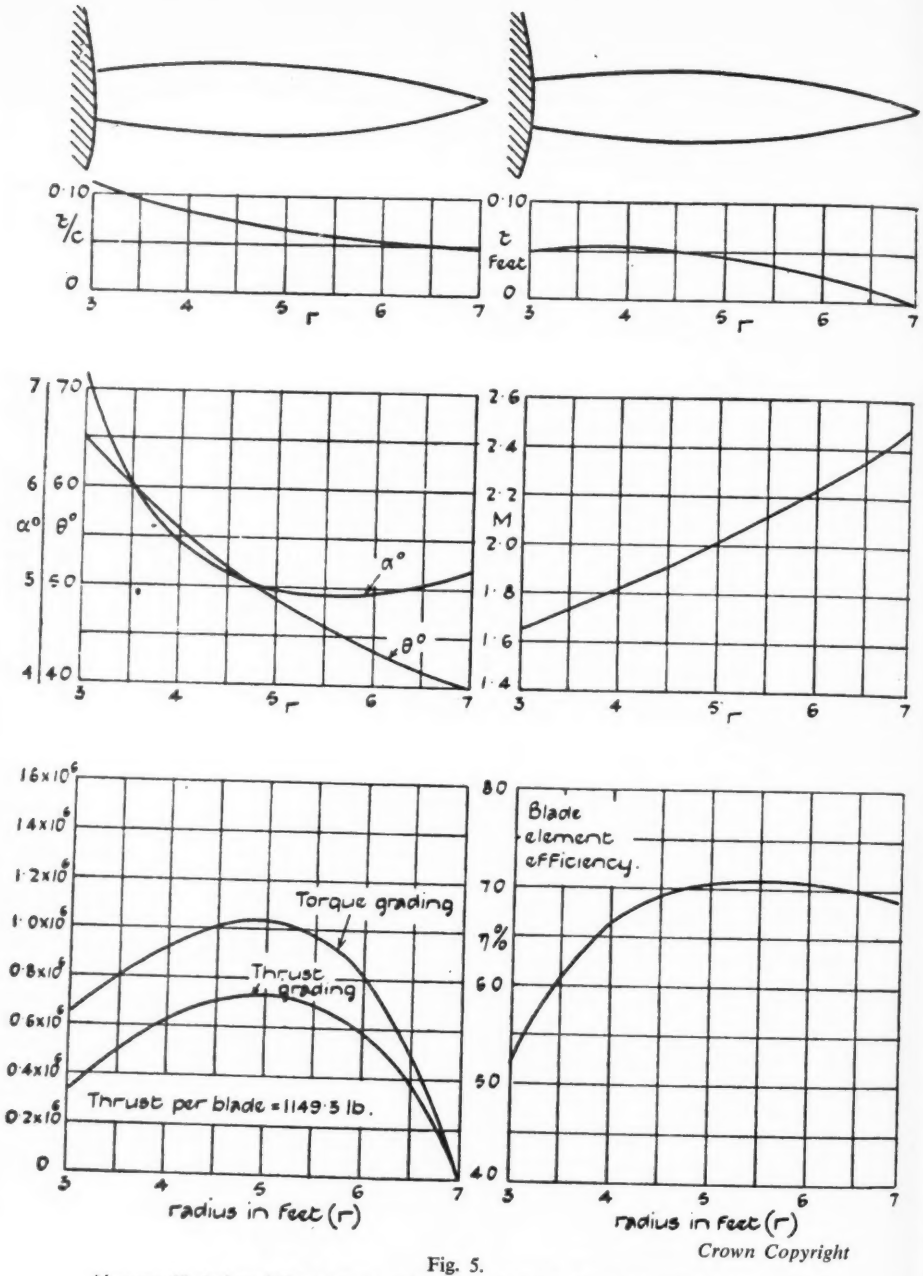

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Fig. 5.

Airscrew II designed for $M = 1.1$ and run at $M = 1.4$ (forward speed 1,078 m.p.h. at sea level) on a constant-speed unit. Overall efficiency = 67.84 per cent., 3,058 r.p.m.

is found in Fig. 5 to have an efficiency of 67.84 per cent. if it is fitted to an aircraft having a forward Mach number of 1.4 instead of 1.1. It is again shown in Fig. 6 to have an efficiency of 66.98 per cent. if it is run at 20 per cent. greater rotational speed than that for which it was designed. It is seen from these figures that considerable departures from the design condition of the supersonic propeller do not impair its efficiency appreciably.

3. PROPELLER NOISE

The noise of the supersonic propeller remains a problem, but all high-powered engines will produce much noise. Since the theory given in Ref. 1 takes account of the shock waves from the blade, it follows that the horsepower radiated in noise is already allowed for in this theory, and will not represent an additional loss. If the aircraft moves at supersonic speeds it will be possible to place the pilot outside the Mach cone from the propellers, and so he would not hear the engine at all. Photographs of propeller shock waves shown at the lecture were taken from Ref. 2, p. 534.

4. ENGINE DESIGN TO DRIVE A SUPERSONIC PROPELLER

It has now been established that no particular theoretical barrier exists which will prevent the use of supersonic propellers up to a Mach number of 3.4. At about this point the thermal stress on the blades will become critical and weaken the blade roots. It is no use discussing propellers unless the engines to drive them are also discussed. The propeller turbine is the obvious choice for aircraft Mach numbers above 0.8. However, there is a definite speed limitation to the gas turbine, brought about by what may be called the thermal barrier, which is discussed later in this paper.

An alternative type of engine which has already been tried for the blades of helicopters, consists of a small ram-jet mounted at the blade tip which is used to propel the blades. If it is found that the weight of the ram-jet unit can be kept down to a sufficiently low value so that the blade roots are not stressed beyond their limit, then this will be a very simple and a very practical means of propulsion of high-speed aircraft. It is so radically different from any existing practice that it would be unwise to attempt to predict its performance and possible uses at this early stage of its development. It would seem to be obvious that the use of a rocket motor at the blade tip as distinct from a ram-jet, would be more wasteful of fuel without showing any particular useful advantage. The external drag of the rocket is less than the corresponding ram-jet, but it is doubtful whether the total weight of the rocket unit would be less than that of the ram-jet, and it is the rotating weight at the blade tip which will be the limitation to this type of propeller propulsion.

As the whole of the propeller blade will be moving at supersonic speeds, it would be possible to fit the ram-jet at the blade root instead of at the blade tip and thus ease the structural problems although decreasing the overall efficiency of the device, as the ram-jet is not particularly efficient at Mach numbers below 2.0.

However, it seems likely that if the supersonic propeller is to be tried at all, it will be driven in the early stages by a gas turbine, and the rest of this paper is devoted to investigation of the limitations, due to the thermal barrier, of the gas turbine as a propulsion unit for supersonic aircraft.

5. THERMAL BARRIER

At the National Physical Laboratory's open day in 1936, the idea of the sonic barrier formed itself in the minds of visiting reporters from the daily Press, who misquoted what was told them about the curve of drag against Mach number rising like a barrier against future progress. Looking ahead at the present time, a new barrier is faced after "climbing" the sonic barrier, namely the Thermal Barrier.

Anything moving through air will experience a temperature rise equal to

$$\frac{V^2}{2JgC_p} \times \text{constant},$$

or, using the extended slug ft. second units defined in Ref. 2,

$J=1$, $g=1$, and $C_p=10{,}800$ ft.^{2}/sec.^{2}/°C.

$$C_p(T_1-T_0)=V^2/2.$$

For stagnation conditions in a pitot-type shock-free entry, as to a jet engine, the constant is equal to unity. For an aerodynamic surface having a turbulent boundary layer the constant equals 0.85 and V is now the velocity just outside the boundary layer. This latter refinement is ignored in this paper and

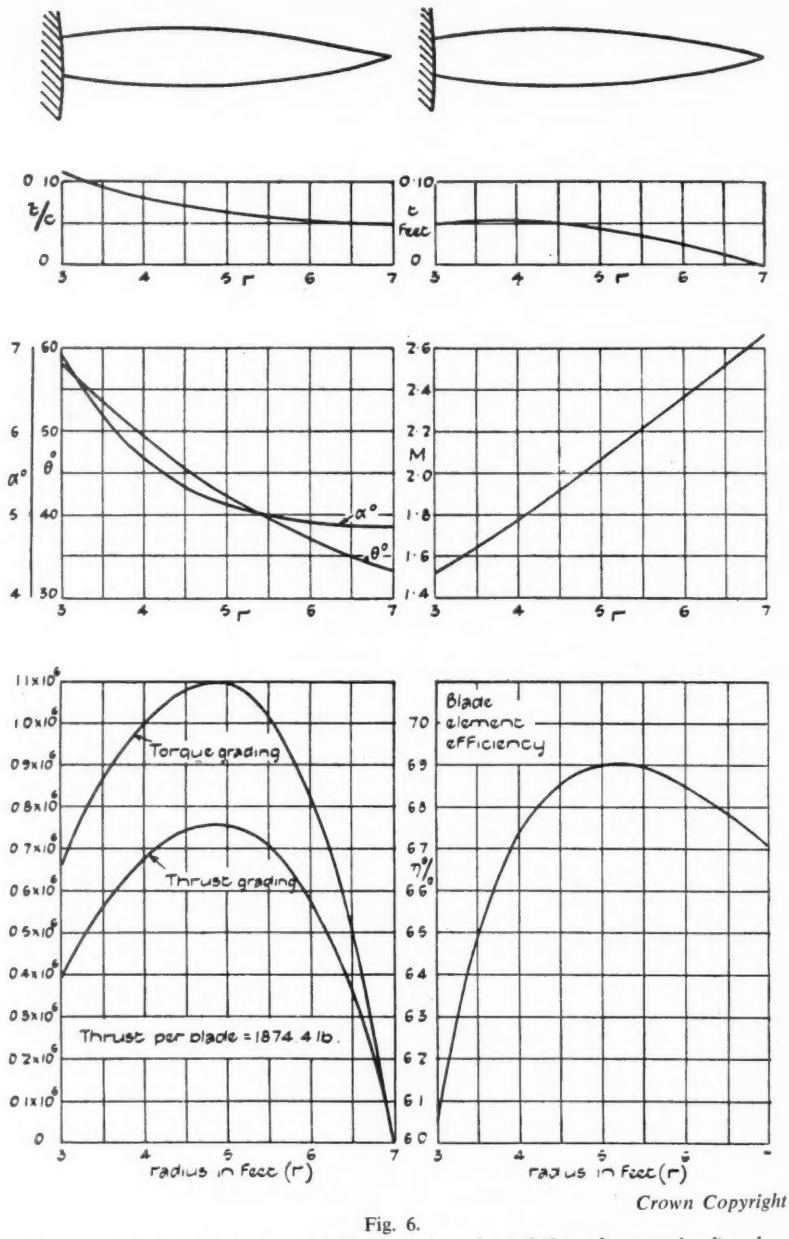

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Fig. 6.

Airscrew II designed for a forward Mach number of 1.1 (847 m.p.h. at sea level) and over-run at 3,664 r.p.m. Overall efficiency = 66.98 per cent.

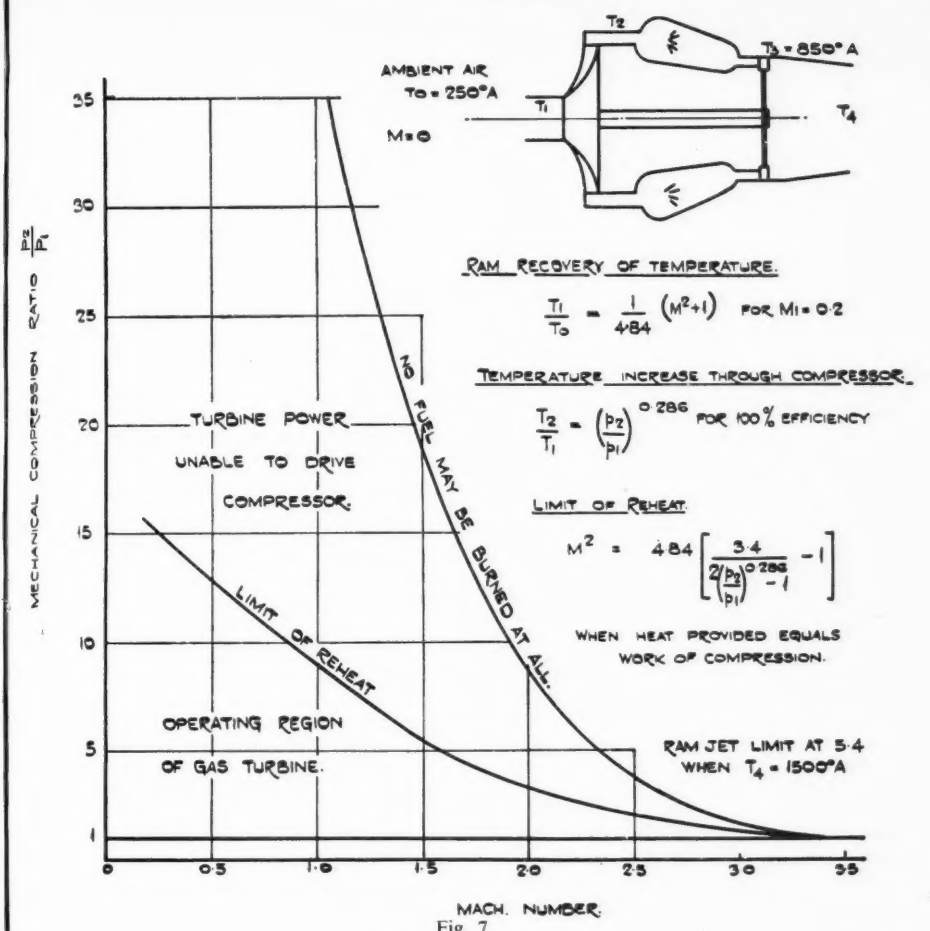

Fig. 7.

all temperatures are treated as though they were obtained by bringing the air to rest relative to the aircraft without loss, instead of through a boundary layer. The errors due to this are less than 10 per cent. in all practical cases.*

It follows that, from wherever pilot's air is supplied, it will be heated 50°C. at $M = 1.0$. At $M = 2.0$, the heating temperature rise is 200°C. and this would represent the limit of human endurance. Therefore the pilot together with a few delicate instruments must be installed in a refrigerator.

*In the course of the Discussion some figures from Ref. 3 were shown, in support of this statement.

Now, at a temperature of 1,500° absolute, steel loses nearly all its mechanical properties and other likely materials have already done so.

This is a definite barrier and it corresponds to a Mach number of about 5.4 for an unpowered glider or bullet flying through air for a sufficiently long time to enable the heat to soak into it. Short duration bullet flights at higher Mach numbers have already been made, but these rely on thermal capacity of the bullet, and low stresses due to low manoeuvrability.

This thermal limit to unpowered flight corresponds roughly to the speed of sound in relation to the sonic barrier, as trouble will

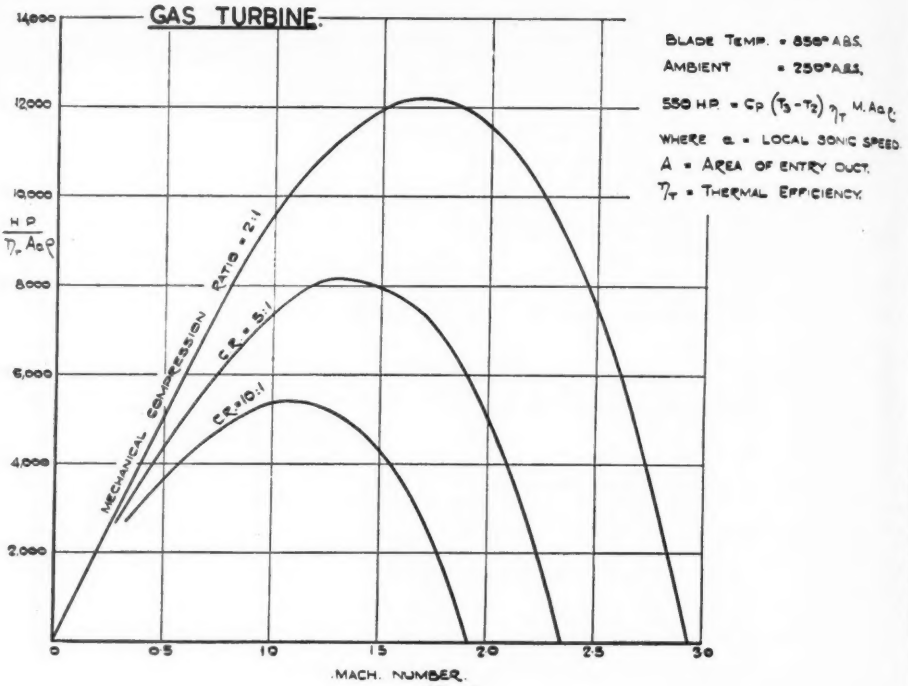

Fig. 8.

be experienced long before this condition is reached, and it will be shown that this "trans-thermal" speed range is far larger than the transonic speed range. Just as an aircraft having zero thickness is required to achieve $M = 1.0$ without shock stalling, so an unpowered or rocket powered projectile is required to exploit to the full the residual mechanical properties of steel as the curves collapse at high temperature.

Considering the air breathing engine; the air coming in to the intake is brought nearly to rest ($M_1 = 0.2$ is assumed) and the full adiabatic temperature rise due to ram compression is experienced. This air then enters the mechanical compressor and is compressed still further, and a further temperature rise takes place. This rise has been assumed to follow the adiabatic law, although in fact it is rather greater than this, as the mechanical losses of the compressor also appear as heat. Thus the derived curves err in favour of the gas turbine, as do all figures in this paper.

If turbine blades are limited to about 600°C. or say 850° absolute, there will be a certain mechanical compression ratio at each Mach number which will produce this temperature without the aid of combustion.

A curve has been plotted in Fig. 7 to show this limitation. Gas turbines lying on this curve will have a large internal drag, zero thrust, and require an external source of power to drive the rotor, but at least they will return to base undamaged.

To take a more practical case, assume that the turbine drives the compressor, by burning just sufficient fuel that if all of it is converted to shaft horsepower at 100 per cent. efficiency, none is left over for propulsion.

The equation arising from this condition is also shown in Fig. 7 as for the curve of limiting compression ratio at each Mach number. The gas turbine will just be able to idle under these conditions, with zero horsepower available externally, and the turbine blades on the point of breaking. However, there is nothing to prevent the burning of extra fuel in the tail pipe, as the tail pipe temperature can be as high as 1,500° absolute without failure. This curve may therefore also be considered as the upper limit of reheat.

Continuing in this vein, it is interesting to examine the best possible performance of three gas turbines, having compression ratios of 2, 5 and 10 to 1. It is assumed that the maximum amount of fuel is burnt at all times, such that the turbine blade temperature is 850° absolute. In order to avoid specifying particular engine sizes and atmospheric conditions, the horsepower is divided by the thermal efficiency, the intake area and air density, and by the speed of sound, to obtain the curves plotted in Fig. 8. The fairly sudden loss of power due to the thermal barrier is notable.

How will progress be made beyond a Mach number of 2.0? The reciprocating engine is not to be ruled out lightly, but this presupposes that sufficient heat can be lost through a liquid radiator placed in the hot air stream streaming past the aircraft. There is no theoretical barrier here, only a formidable problem of mechanical engineering. Alternatively, intercooling between or after the compressor stages of a gas turbine should be considered. An additional problem arises here, as the heat from a fast moving gas stream in the compressor has to be transferred to the liquid, and then to the outside of the aircraft.

It thus appears that any form of engine using mechanical compression of the air is likely to be limited to a Mach number between 2 and 3 while the upper limit to the use of a ram-jet is likely to be between Mach numbers of 4 and 5, and this will enable the ram-jet propeller to function to much higher speeds than the gas turbine.

At these very high speeds, all air breathing motors will have to fight competition from the ordinary rocket motor which, although it suffers from the disadvantage of carrying its own oxygen with it, has the compensating advantage that no thermal barrier problems arise other than those encountered by the external structure exposed to the air.

6. CONCLUSION

In preparing this paper for publication after the lecture, and taking into account the very full Discussion, it appears to the author that there is no particular disadvantage either theoretical or practical, of the supersonic propeller and what is needed at the present time is someone with over-powering enthusiasm, plus a certain amount of financial backing and ability, who would do for the supersonic propeller what Sir Frank Whittle has done so well for the gas turbine.

There is no question as to whether the gas turbine or the supersonic propeller is superior; each will have its own sphere of usefulness—the gas turbine for lightness and relative simplicity, and the supersonic propeller for high-speed aircraft where long range fuel economy and short take-off and landing runs are essential (as for shipboard use). The advantages of using the supersonic propeller as a brake should not be overlooked.

Mr. Thatcher's point, made during the Discussion, is very well taken that the three variables of altitude, speed and range are interchangeable, and good performance in one respect can be obtained by sacrificing the other two. The type of aircraft propulsion chosen will depend on the operating requirements of the aircraft.

In conclusion, it is hoped that care will be taken to distinguish between the two halves of this paper, the second half having been to a large extent more speculative than the first half.

ACKNOWLEDGMENTS

The author acknowledges with thanks permission from the Controller, H.M. Stationery Office, to reproduce Figures 2, 3, 4, 5 and 6 from R. & M. 2345.

REFERENCES

1. HILTON, W. F. (1946). Theory and Use of the Supersonic Airscrew. R. & M. 2345, August 1946.
2. HILTON, W. F. (1951). *High Speed Aerodynamics*, Longmans, Green & Co. Ltd., New York, 1951.
3. HILTON, W. F. (1951). Wind Tunnel Tests for Temperature Recovery Factors at Supersonic Velocities. Reprinted from *Journal of The Aeronautical Sciences*, 1951. .

   Also pages 524-530 of Ref. 2.

INSTRUMENTATION FOR TESTING AIRCRAFT AND AERO-ENGINES*

by

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1. INTRODUCTION

The term Aircraft Instrumentation is used to describe the special instruments which in a variety of circumstances are needed to determine aerodynamic, structural and power plant characteristics. Such circumstances may be flight tests of prototype aircraft, tests in the air or on the ground of the aeroplane, its structure or power plant, or the acquisition of statistical data on the conditions to which aircraft are subjected in civil or military operation. These special instruments therefore are additional to, and usually different from, the instruments needed in an aeroplane to enable it to fulfil its military or civil role.

The subject is dealt with from the viewpoint of an engineer whose concern was the development of such instruments. There are others better qualified to discuss both the flight testing methods in which they are used and the interpretation of the information they provide.

Since aircraft instrumentation is essentially the measurement of physical quantities which are varying in value, it is proposed

(*i*) to outline the basic principles of dynamic measurements,

(*ii*) to illustrate the measurement of physical quantities by examples of some of the newer instruments,

(*iii*) to refer briefly to data transmission systems,

(*iv*) to describe some of the continuous-trace recording equipments now becoming available from British sources for use in flight.

*A Joint Lecture to the Southampton Branch of the Royal Aeronautical Society and to the Southern Branches of the Institution of Electrical Engineers and the Institution of Mechanical Engineers on 11th April 1951.

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NOTATION AND ABBREVIATIONS

P	amplitude of impressed sinusoidal force $P \sin pt$
M_1	$1/\{(1-n^2)^2+4h^2n^2\}^{\frac{1}{2}}$
n	(frequency of impressed force)/(undamped natural frequency of instrument)
h	(damping coefficient)/(critical damping coefficient)
k	linear stiffness of spring
ψ	phase angle $[=\tan^{-1}\{2hn/(1-n^2)\}]$
t	time
y	displacement of mass
M_2	$1/\{(1-1/n^2)^2+4h^2/n^2\}^{\frac{1}{2}}$
x	amplitude of sinusoidal vibration $x \sin pt$
p	$2\pi \times$ impressed frequency
q	amplitude of pressure $q \sin pt$
a	amplitude of acceleration $a \sin pt$
m	mass
A_1	area over which q is effective
ω	$2\pi \times$ undamped natural frequency
g	acceleration due to gravity
v	velocity of discharge from an orifice
C_v	velocity coefficient $[=v/(2gH)^{\frac{1}{2}}]$
H	change in pressure head
Δp	pressure drop across orifice
ρ	fluid density
V	fluid volume
M	fluid mass
C_A	coefficient of reduction of area
A	area of orifice
C_d	discharge coefficient $(=C_A C_v)$
R	resistance of wire
ρ_1	specific resistance of wire
l	length of wire
a_1	cross-sectional area of wire
σ	Poisson's ratio for material of wire
e	strain $(\Delta l/l)$
s	strain sensitivity
r.m.s.	root mean square

2. BASIC PRINCIPLES OF DYNAMIC MEASUREMENTS

Since most indicating and recording instruments (a notable exception is the cathode ray tube) possess inertia in one or more of their component parts, it is important to appreciate the conditions under which they can respond faithfully to physical quantities which are varying in value.

Many such instruments may be considered as a single mass suspended on a linear spring with damping, either mechanical or electrical, proportional to the velocity of the mass, if it is assumed that care is taken that friction damping is negligible. It can be shown that, if a sinusoidal force $P \sin pt$ is impressed on such a system, the movement of the mass is given by

$$y = M_1 (P/k) \sin (pt - \psi) \quad . \qquad (1)$$

where

$$M_1 = 1/\{(1-n^2)^2 + 4h^2 n^2\}^{\frac{1}{2}}.$$

Therefore the displacement of the mass varies in the same way as the impressed force, lags behind it by the phase angle ψ and, provided that $M_1 = 1$, its amplitude P/k is the displacement which would be produced by a static

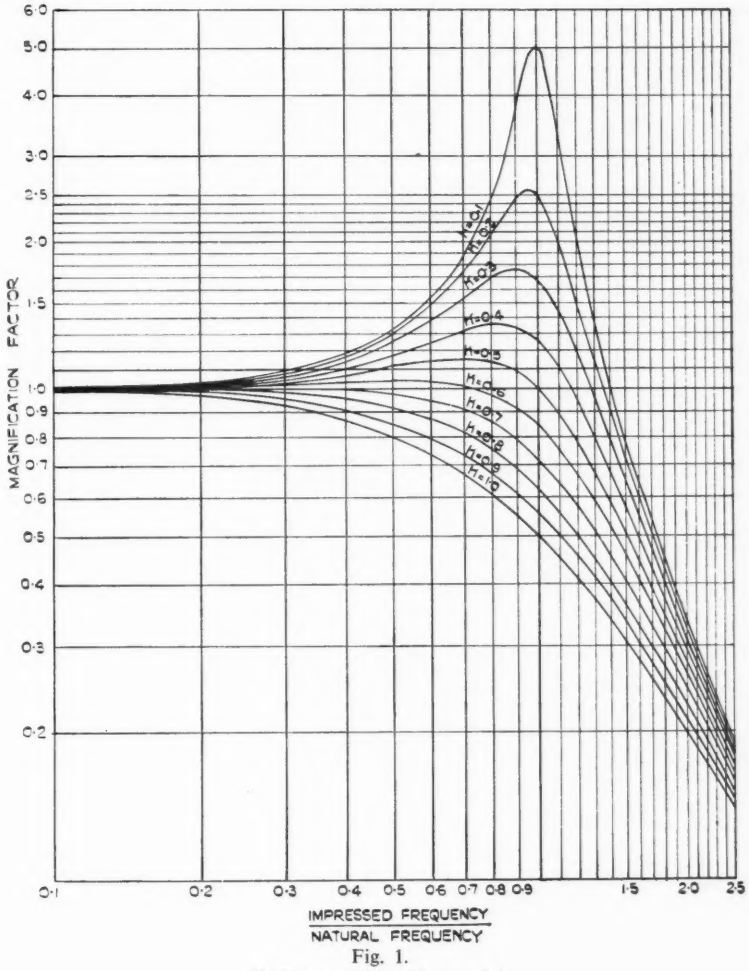


Fig. 1.
Variation of M_1 with n and h.
(The parameter K used in this figure corresponds to h used in the text.)

force of magnitude equal to the amplitude of the dynamic force.

The first requirement therefore is to ensure that the dynamic magnification factor M_1 does not depart seriously from unity. Values of M_1 are plotted against n in Fig. 1 for different values of h. It will be seen that, in order to avoid amplitude distortion of impressed frequencies up to the highest possible fraction of the instrument's undamped natural frequency, the damping factor h should be between 0.6 and 0.7. For example, if a damping factor of 0.64 can be secured the undamped natural frequency of the instrument need only be 50 per cent. greater than the impressed frequency, yet the accuracy of amplitude response is within ± 2 per cent.; on the other hand, if the damping factor is 0.1 or less the same accuracy can only be achieved if the undamped natural frequency of the instrument is seven times that of the impressed frequency.

If the measurement is to be recorded it is necessary to consider the implications of the phase angle ψ by which the motion of the mass lags behind the impressed force. This lag is important if the physical quantity to be measured

(*a*) consists of a number of sinusoidal variations of different frequencies; in this case each component is displaced along the time axis by a different amount, hence the wave-form is distorted,

(*b*) is of a transient nature,

(*c*) is one of a number of physical quantities of different frequencies to be recorded on the same time base.

Values of ψ are plotted against n in Fig. 2, for different values of h. It will be seen that, for a damping factor h of 0.7, the phase angle ψ is proportional to the impressed frequency; since the time lag is equal to $\psi/(2\pi \times$ impressed frequency), the signal, whatever its form, will merely be displaced along the time axis without distortion.

It will be obvious that the foregoing conclusions are applicable to the measurement of fluid pressure if the appropriate substitution is made for P in equation (1). They are also

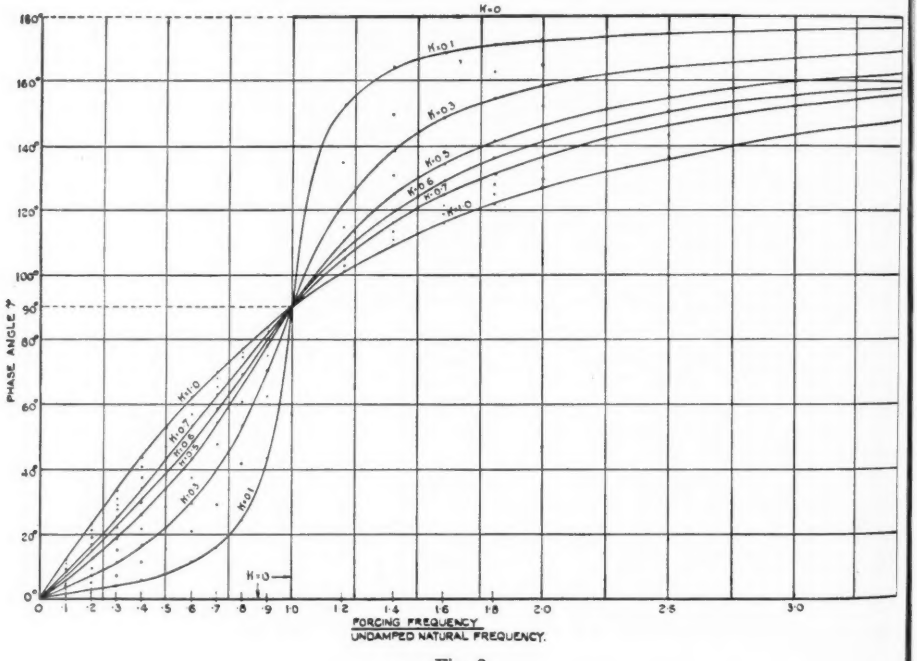


Fig. 2.

Variation of phase angle with damping for a mechanical system.
(The parameter K used in this figure corresponds to h used in the text.)

applicable to the measurement of acceleration, as will be seen if the substitution $P=$ mass $\times$ acceleration is made.

If the damped mass-spring system is subjected to a sinusoidal vibration ($x \sin pt$) it can be shown that the movement of the mass is given by

$$y = M_2 x \sin(pt - \psi) \quad . \quad (2)$$

where $M_2 = 1/\{(1-1/n^2)^2 + 4h^2/n^2\}^{\frac{1}{2}}$.

Values of M_2 are plotted against n, for different values of h, in Fig 3, which is seen to be a mirror image of Fig. 1. So in order to avoid amplitude distortion a lower, instead of an upper, limit must now be set to the impressed frequencies. If a damping factor of 0.64 can be secured this limit need only be 50 per cent. greater than the undamped natural frequency of the instrument, yet the accuracy of amplitude response is within ± 2 per cent.; on the other hand, if the damping factor is 0.1 or less, the same accuracy can only be achieved if the lower limit of the impressed frequencies is raised to seven times the undamped natural frequency of the instrument.

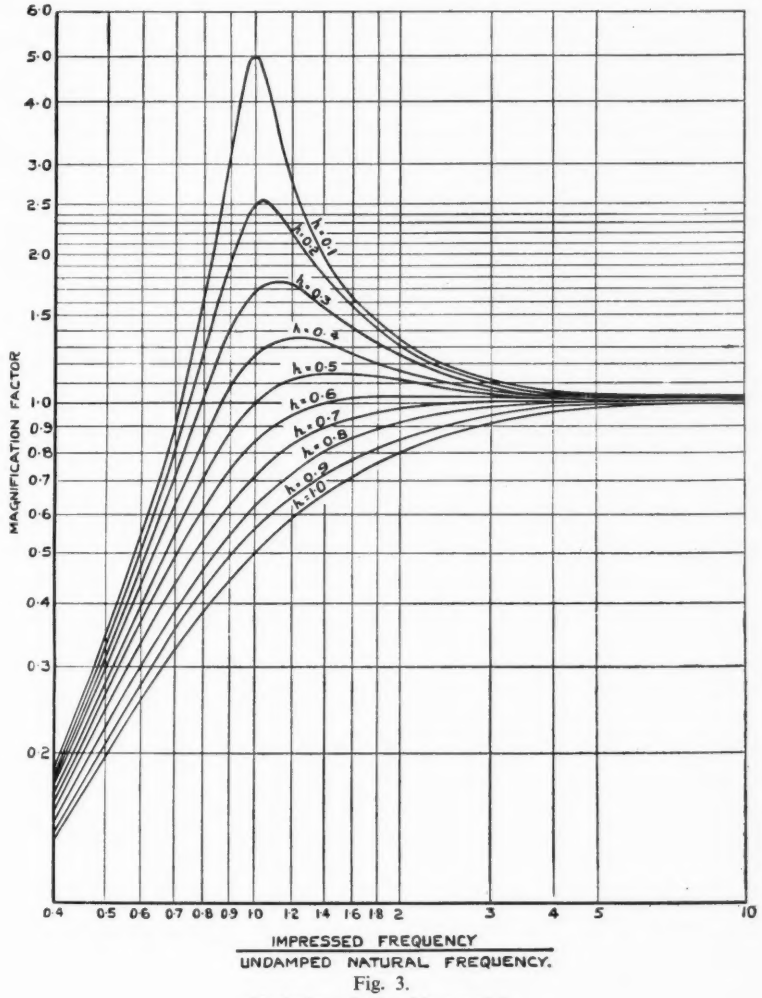


Fig. 3.
Variation of M_2 with n and h.

It will be seen from Fig. 2 that phase distortion of vibrations containing harmonics can only be avoided when the damping factor is low, the phase lag then being 180°. A reasonable compromise between amplitude and phase distortion is to make the damping factor equal to 0.4.

The sensitivity of the system, in measuring vibration amplitude, is unity and is independent of its undamped natural frequency, as can be seen from equation (2). It can be shown that the sensitivity of the system, in measuring acceleration, pressure or force is inversely proportional to the square of its undamped natural frequency; if therefore, in order to avoid amplitude distortion, the undamped natural frequency has to be made greater than, say, 20 cycles/sec. it will be necessary to arrange that the displacement of the mass causes a proportional change in some electrical quantity, so that the sensitivity lost may be regained by electronic amplification.

These conclusions are summarised in Table I.

3. MEASUREMENT OF PHYSICAL QUANTITIES

3.1. Acceleration

The measurement of acceleration affords a good example of the application of the principles outlined in Section 2, because the choice of equipment, if gross inaccuracy is to be avoided, depends on whether the acceleration is

(*a*) constant or varying only slowly, when a direct reading instrument may be used,

(*b*) varying more rapidly in a manner which can be predicted (*e.g.* as on application of the aircraft controls), when a mechanical or electro-mechanical instrument may be used, provided that optimum damping is arranged,

(*c*) a transient of unknown form (*e.g.* as in a gust or on landing), when a pick-up of high natural frequency with preferably optimum damping, followed by electronic amplification, should be used.

Whatever the equipment used the principle employed in measuring acceleration is that of the spring balance, *i.e.* a mass suspended on a spring, the deflection of the spring being proportional to the acceleration affecting the mass. It is only the methods of measuring that deflection and of providing damping which vary.

The Kelvin-Hughes indicating accelerometer and the Royal Aircraft Establishment (R.A.E.) transmitting accelerometer are familiar examples of instruments suitable respectively for (*a*) and (*b*).

For category (*c*) acceleration pick-ups have been designed in which the electrical quantity varied has been resistance or inductance or capacitance. It is therefore desirable to establish whether any particular one of these electrical quantities is to be preferred.

TABLE I

Force $P \sin pt$	*Pressure* $q \sin pt$	*Acceleration* $a \sin pt$	*Vibration* $x \sin pt$
Response			
$y=M_1(P/k)\sin(pt-\psi)$	$y=M_1(qA_1/k)\sin(pt-\psi)$	$y=M_1(ma/k)\sin(pt-\psi)$	$y=M_2x(\sin pt-\psi)$
$M_1=1/\{(1-n^2)^2+4h^2n^2\}^{\frac{1}{2}}$	⟵ M_1	⟵ M_1	$M_2=1/\{(1-1/n^2)^2+4h^2/n^2\}^{\frac{1}{2}}$
$\tan\psi=2hn/(1-n^2)$	⟵ $\tan\psi$	⟵ $\tan\psi$	⟵ $\tan\psi$
For M_1 or M_2 to be within ± 2 per cent. of unity			
$h=0.64$, $0<n<0.66$	⟵ n	⟵ n	$1.5<n<\infty$
$h=0.1$, $0<n<0.14$	⟵ n	⟵ n	$7<n<\infty$
For phase distortion to be small (ψ proportional to p/ω)			
$h=0.7$	⟵ h	⟵ h	$h<0.1$
Sensitivity			
$y/P=1/k=1/(m\omega^2)$	$y/q=A_1/k=A_1/(m\omega^2)$	$y/a=m/k=1/\omega^2$	$y/x=1$

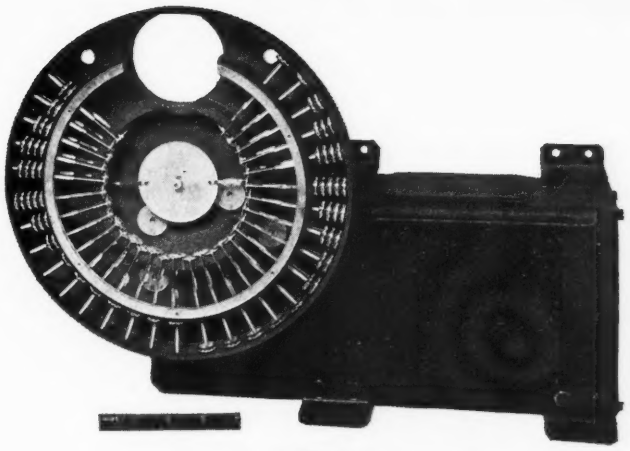


Fig. 4.
Counting accelerometer.

Resistance pick-ups may be of two kinds. In the first (bonded) type the force due to the acceleration of the mass is arranged to stress some mechanical member in which the resultant strain is measured by bonding to it, with adhesive, wire resistance strain gauges of the conventional type. In the second (unbonded) type the acceleration force is applied directly to a pre-tensioned fine wire to vary its length and consequently resistance. It can be shown that, for pick-ups of acceleration ranges 10*g* or 100*g* and natural frequencies of 260 and 1,000 cycles/sec. respectively, the weight and bulk of any bonded type will be considerably greater than those of an unbonded type of the same sensitivity.

It can also be shown that an inductance pick-up, of the same acceleration range and natural frequency, when used in a bridge having the same input voltage and number of active arms, can give a bridge output voltage ten times greater than an unbonded wire-resistance pick-up. A consequent advantage of its greater fractional change in impedance is that the inductance pick-up has a better signal-noise ratio.

A capacitance pick-up has a maximum sensitivity of about half that of an inductance pick-up. It is considerably bulkier and, because of the hyperbolic relationship between capacitance and the separation of the condenser plates, the achievement of a linear relationship between capacitance and movement demands tedious adjustment.

The choice therefore lies between an unbonded wire resistance pick-up and an inductance pick-up, the latter being preferred if the utmost sensitivity is needed.

In order to permit design factors to be revised, with safety, in the direction which will allow a lower structure weight and thus a higher useful load, it is desirable to obtain during the operation of civil and military aircraft statistical information on the frequency distribution of acceleration normal to the flight path. Because of the tedium of analysing, for this purpose, long continuous-trace records of acceleration, several attempts have been made to devise an accelerometer to count the number of times accelerations of various threshold values are exceeded; it has not been possible, however, to rely on their indications because, on comparison with continuous-trace records, it was found that local vibration caused them to miscount.

In a recently designed counting-accelerometer (due to J. Taylor, of the Structures Department, R.A.E.) it is believed that this defect has been overcome. In order to achieve a greater attenuation of accelerations with a frequency greater than 10 cycles/sec. and a sharper cut-off at that frequency in the response, two coupled mass-spring systems are used (a mechanical analogy of the electrical low-pass filter). The first mass-spring system is similar to that found in all accelerometers; the second comprises a rotary inertia (with equivalent mass equal to 0.35 that of the first mass) coupled by an

endless belt and spring (with equivalent stiffness equal to 1.25 that of the first spring) to the mass of the first system. A double-ended pointer (Fig. 4) attached to the rotary inertia actuates the ratchet wheels of counters arranged around its periphery in steps of 0.1*g* up to 1*g* above and below the static condition (*i.e.* between 0 and $+2g$) and in steps of 0.2*g* up to 2*g* above and below that datum (*i.e.* between $-1g$ and 0*g*, and between $+2g$ and $+3g$). When the acceleration first crosses any particular threshold the pointer merely passes over the ratchet wheel tooth; the ratchet wheel is moved on one tooth when the threshold is crossed in the reverse direction as it must be. Miscounting due to the inertia of the mechanical counter is avoided by interposing a flexible shaft between it and the ratchet wheel. Optimum velocity damping is secured by eddy currents set up in an aluminium cylinder which is geared up 9 to 1 to rotate in a magnetic field. The instrument weighs 12 lb. and its size is 17.8 in. long × 13 in. high × 5.35 in.

3.2. Engine speed

For test beds or performance test flying, turbine engine speed must be determined with greater accuracy than the ±100 r.p.m. of which the electro-mechanical tachometer is capable. Using an electronic tachometer engine speed can be determined to within one r.p.m. over the range 200 to 5,000 r.p.m. or within 10 r.p.m. over the range 400 to 20,000 r.p.m. The method employed is to count the number of revolutions occurring in a standard time interval. An electronic counter is used in order to permit a very short, yet accurately known, time interval to be employed for the period of counting.

In such equipment, developed for test-bed use, the standard time interval of one second is derived (Fig. 5) from a valve-maintained tuning fork, accurately adjusted and having a low temperature coefficient of frequency so that accuracy may be maintained over an ambient temperature range of between 0° C. and 35° C. The fork operates at a frequency of 1,000 cycles/sec. and a signal from it is fed to a chain of frequency dividers, having a division ratio of 1,000:1, to produce pulses occurring once per second. The one-second pulses are fed to a self-locking electronic relay stage which is operated by the first pulse to arrive after pressing the "start" button. In effect, this relay is a gate which opens for exactly one second and transmits any applied signal for this period only. After the interval of one second it closes automatically, and the total number of pulses in the applied signal which have passed through in one second are registered on a counter.

The applied signal, whose frequency is proportional to engine speed, is obtained from the unmodified generator of a Mk. 7 tachometer. This generator is driven direct from the engine on range (*a*), through a 2:1 reduction gear on range (*b*) and a 4:1 reduction on range (*c*). In each case the generator speed range will be 200 to 5,000 r.p.m. corresponding to a frequency range of $3\frac{1}{3}$ to $83\frac{1}{3}$ cycles/sec. This generator, which is a standard installation on the engine, may also be connected to either one or two conventional indicators, as the electronic tachometer has a high input impedance, thus imposing negligible additional loading on the generator.

Since the input to the apparatus from the engine speed generator on all ranges has a frequency of $3\frac{1}{3}$ to $83\frac{1}{3}$ cycles/sec., some method is necessary for translating the frequency

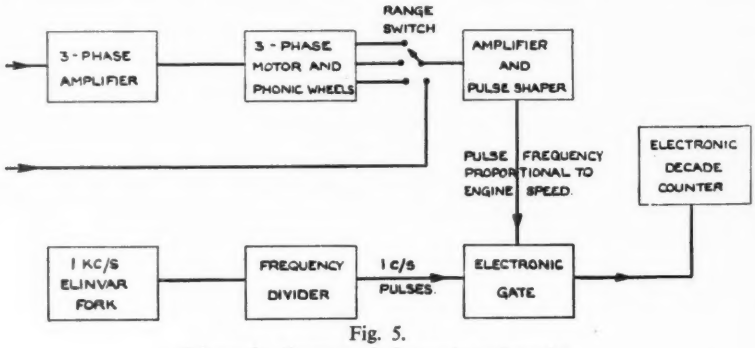
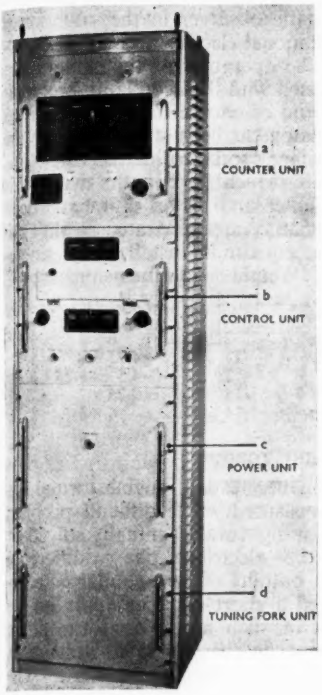


Fig. 5.
Schematic diagram of electronic tachometer.



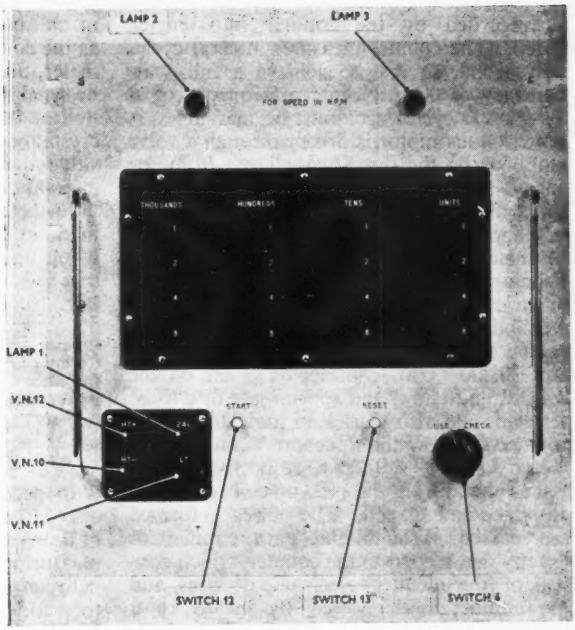


Fig. 6.

Complete equipment.

Counter unit. Front view.

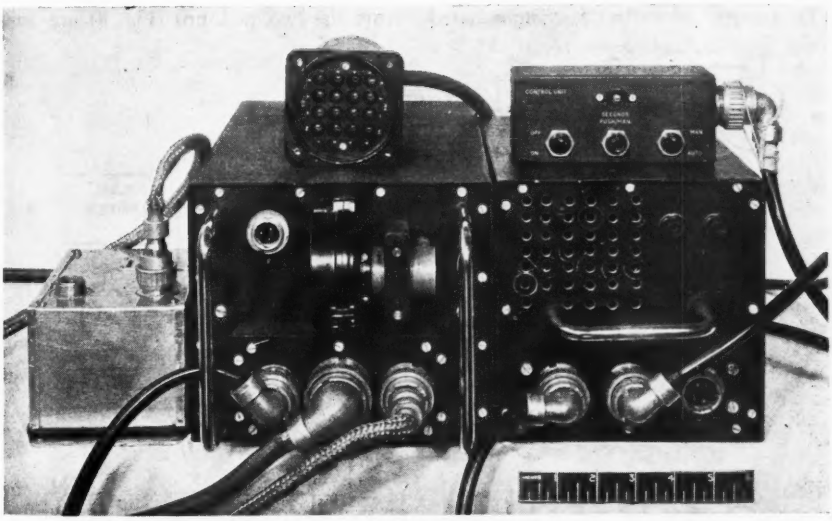


Fig. 7.
Electronic tachometer (airborne).

as recorded by the counter into engine speed. The counter measures integral cycles per second, so that to achieve a full scale accuracy of 0.1 per cent., a frequency of at least 1,000 cycles/sec. must be measured. A synchronous motor is driven through a valve amplifier by the three-phase input from the engine speed generator. This motor drives three discs of magnetic material having 60, 12 and 24 teeth respectively. Electromagnetic pick-up coils associated with these phonic wheels produce signals having frequencies of 5,000 cycles/sec., 1,000 cycles/sec. and 2,000 cycles/sec. respectively for top engine speeds of 5,000 r.p.m., 10,000 r.p.m. and 20,000 r.p.m. A selector switch on the control unit allows the appropriate disc to be selected, and also causes an indicator on the counter to show the appropriate multiplying factor (*i.e.* $\times 1$, $\times 10$, $\times 10$ respectively).

The signal from the pick-up coil selected is amplified and shaped. The pulses so formed are passed through the gate circuit for exactly one second to the counter, which consists of four identical electronic decades, and the number is registered by means of a pattern of neon lamps. The engine speed is read directly from the counter panel. The "re-set" button may then be pressed to cancel the count before taking a further reading (Fig. 6).

An airborne version of this electronic tachometer has recently been developed (Fig. 7). The indicator can be accommodated in an automatic observer in the same space as the conventional electro-mechanical tachometer, and the operation of the camera can be synchronised with the neon lamp presentation at the end of each electronic count. A crystal oscillator has been substituted for the valve-maintained fork to define the time interval during which the count is made; this unit, the counter and power unit have been made in miniature and separated so that the whole equipment can be installed in a single-seat fighter. Weights and dimensions are:—

	Weight (lb.)	*Length × Width × Height (in.)*
Inpulse generator	2.25	$6 \times 4.5 \times 3.5$
Counter	17	$14.75 \times 8 \times 7$
Indicator	2	$4.5 \times 3.25 \times 3.25$
Power unit	15	$10.75 \times 7 \times 7$
Control	1	$6 \times 3 \times 2.625$

3.3. Engine Torque

In performance testing, engine torque has also to be measured. The difficult problem of doing so in flight was eventually solved by measuring the electrical phase difference between the outputs of two similar alternators, mounted a short distance apart on the engine shaft in such a way that the phase difference between the generated voltages is proportional to the twist in the shaft. The alternators each consist of a toothed wheel fixed to the shaft and a stationary electromagnetic-coil system.

Initially, the alternating voltages derived from the two pick-ups (Fig. 8) are handled

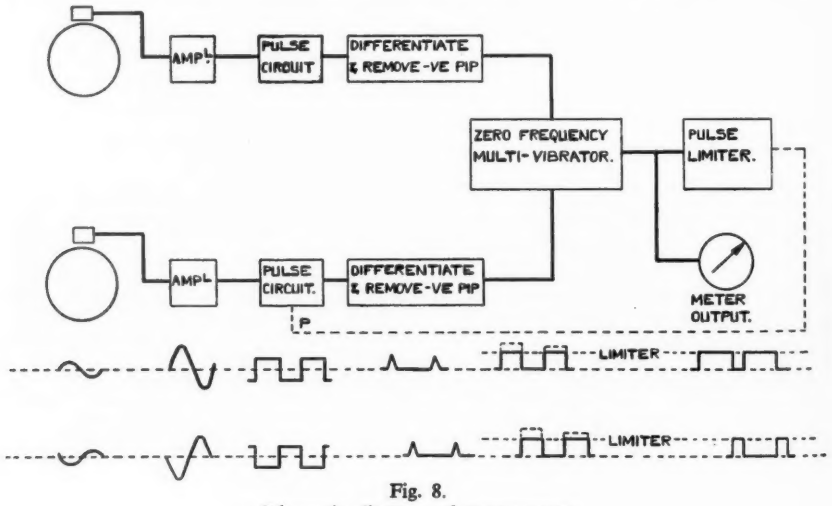


Fig. 8.
Schematic diagram of torquemeter.

separately by two similar electronic circuits. Each voltage is amplified and passed through a limiter to a pulse generator, giving two pulses for each cycle. A discriminator then eliminates every other pulse. These pulses, which are of short duration and are synchronous with the original sine wave produced by the alternator, occur at the instant at which the positive-going half of the sine wave passes through zero level. The two trains of pulses, time locked to the two sources of alternating voltage, are then applied to the opposite sides of a D.C. trigger-pair. The time that the D.C. trigger-pair spends in either of its two stable states depends on the time spacing of the two trains of pulses. A meter is arranged to indicate the relative time spent by the trigger-pair in either stable state and it follows that this is a measure of the phase relationship of the two sine waves. The electronic circuits are housed in one unit (Fig. 9) which is mounted in an anti-vibration tray, of overall dimensions 7 in. high × 10½ in. deep × 3¾ in. and of weight 8 lb.; the meter and controls are housed in a second unit of dimensions 7 in. high × 4 in. deep × 4¼ in. and weight 2¾ lb. The equipment operates from a supply voltage of 22 to 29 volts D.C. (a mains-operated version is under development) and consumes 100 watts.

The total error in the indication can be reduced to less than 1.5° electrical phase difference provided that fluctuations in supply voltage are eliminated, the instrument is allowed 30 minutes to attain its working temperature and care is taken to make the signals from the two pick-ups equal in magnitude and as large as possible within the range 6 to 60 microvolts into the 47,000 ohms input impedance of the instrument.

3.4. Fuel flow

The primary fuel flow measurement required in aeroplane and engine performance testing is the instantaneous rate of fuel flow. Although this is often obtained by measuring the time taken for the passage of a given quantity of fuel (as in the Kent fuel flowmeter), the measurement of the total quantity of fuel consumed is of secondary importance and is insisted on now only for weight estimation, because of lack of faith in existing means of measuring the amount of fuel in the tanks. It must not be overlooked that the estimation of fuel tank contents from an

Fig. 9.
Electronic torquemeter.

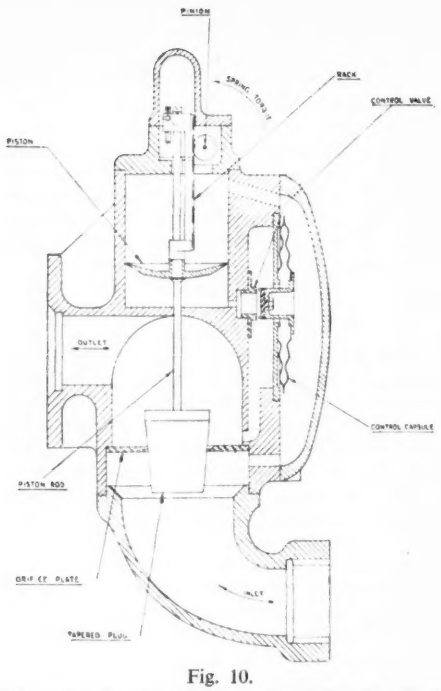


Fig. 10.
Schematic diagram of Negretti and Zambra Fuel Flowmeter.

indication of total fuel consumed cannot take account of loss by evaporation or leakage.

It is preferable that the measurement be made in terms of mass, not volume, because volume must be converted to mass for estimation of engine performance. Some meters which do measure instantaneous mass rate of fuel flow are unsuitable for use in the air because their principle of operation is such that either accuracy is reduced by acceleration or attitude of the aeroplane, or else the application of a system of remote indication, which is essential in order to keep fuel out of the fuselage, is difficult. Where the principle of operation is such that these drawbacks do not apply, compensation for the temperature of the fuel can be introduced into the metering unit and the instantaneous mass rate of flow can be determined so long as use is confined to the particular grade of fuel for which the metering unit has been designed.

The fuel meter developed by Negretti and Zambra provides at a point, which is connected electrically to the metering unit, continuous indication of the instantaneous rate of fuel flow. By introducing in the metering unit appropriate compensation for the temperature of the fuel, the indication may be made mass rate of flow for a particular grade of fuel. The metering unit which is of the constant pressure difference-variable orifice type is arranged to operate a Smith Asynn electrical transmitter, for which a 26 volt 400 cycles/sec. A.C. supply is required.

Since the velocity of discharge from an orifice is given by

$$v = C_v (2gH)^{\frac{1}{2}} = (2g\,\Delta p/\rho)^{\frac{1}{2}},$$

it follows that the volume and mass rates of flow are given by

$$dV/dt = C_A A v = C_d A (2g\,\Delta p/\rho)^{\frac{1}{2}}$$

and

$$dM/dt = \rho C_A A v = C_d A (2g\rho\Delta p)^{\frac{1}{2}}.$$

If Δp is kept constant, dV/dt is proportional to $A/\rho^{\frac{1}{2}}$ and dM/dt to $A\rho^{\frac{1}{2}}$.

The pressure drop across the orifice is kept constant by using a small proportion of the flow through the metering unit to establish a constant pressure difference between the two sides of a piston, which is fixed to the same rod as a tapered plug in the orifice (Fig. 10). This by-passed flow is led from the upstream side of the orifice to the upper side of the piston, which is a loose fit in its cylinder. The by-passed flow thus leaks past the piston and reaches the downstream side of the orifice through a valve, whose opening is controlled by a capsule which is exposed to the pressure drop across the orifice.

When there is no flow of fuel through the metering unit the piston rod is kept down on a datum stop, so that there is only a small clearance between the tapered plug and the orifice, by a light torsion spring on a pinion engaging with a rack on the piston rod. When fuel starts to flow, a pressure difference will be developed across the orifice, so the capsule will collapse and close the valve, stopping the by-pass flow. As there is then no pressure difference across the piston, the pressure difference across the orifice, acting on the cross-sectional area of the tapered plug, will cause the plug and piston-rod assembly to move upwards. This movement will continue until the decrease in the pressure difference across the annular orifice, due to the increase in its area, allows the capsule-controlled valve to open and the by-pass flow to re-start. The valve will continue to open and the by-pass flow to increase until

the pressure difference across the piston provides enough downward force to balance the upward force on the tapered plug. Any overshoot or subsequent reduction in flow will cause a further drop in pressure across the orifice, so that the valve opens still further to increase the pressure difference across the piston; the downward force on the piston then exceeds the upward force on the tapered plug, which consequently moves down until the balance of forces is restored.

For all steady values of flow through the metering unit, the by-pass flow, capsule-controlled valve opening, pressure drop across the piston and pressure drop across the orifice are all constant. Although this pressure drop is only about 1.25 lb./in.^{2}, the control forces, because of the large cross-sectional areas of the tapered plug and piston, are large, rising to 2 lb. if the pressure drop increases by as little as 0.1 lb./in.^{2} Moreover the movement of the piston rod, as measured by the rotation of the pinion engaging with the rack, bears a linear relationship to the increase in the area of the orifice, provided that the ratio of the annulus width to orifice diameter is small. It will be clear from the foregoing equations that the movement of the piston will bear a linear relationship to either mass or volume rate of flow only so long as the density of the fuel is constant. In either case, therefore, for fuel of a particular grade it is necessary to introduce compensation for the temperature of the fuel, if this is likely to vary appreciably. This is done by arranging that the pressure difference, at which the capsule-controlled valve closes, decreases as the fuel temperature decreases, if an indication of mass rate of flow, which is independent of the varying temperature of a particular grade of fuel, is required; the temperature compensation is applied in the opposite sense if an indication of volume rate of flow, which is independent of the varying temperature of a particular grade of fuel, is required.

As the flow through the orifice is turbulent, variation in the viscosity of a particular grade of fuel with temperature does not affect the calibration.

A filter for the by-pass flow is provided to protect the piston and capsule-controlled valve. Because of the large area of the orifice, no filter is necessary for the main flow. As the control forces are large, the meter is unlikely to jam and restrict the flow of fuel; but in order to cater for mechanical seizure, the tapered plug is not fixed to the piston rod, a pre-compressed spring being interposed so that if the pressure drop across the orifice increases to 1.75 lb./in.^{2} the tapered plug will move up the piston rod sufficiently to allow the maximum flow, for which the metering unit is designed, at a pressure drop of 3 lb./in.^{2}

It will be appreciated that the indicating scale may be opened over the lower part of the range, at the expense of closing it over the remainder, by varying the shape of the tapered plug from the straight taper which provides a linear scale of flow rate.

The size of the metering unit (Fig. 11) with Asynn transmitter, is $10\frac{3}{4}$ in. $\times 8\frac{1}{8}$ in. $\times 4\frac{1}{2}$ in. and its weight is 7 lb.; the Asynn indicator is housed in a $3\frac{1}{8}$ in. S.A.E. case and weighs one pound.

At normal temperature the accuracy of the metering unit is ± 0.5 per cent. full scale and the overall error, including transmission and indicator, is within ± 1.0 per cent. full scale.

3.5. Strain

For the measurement of strain the wire resistance strain gauge has virtually ousted mechanical, optical, inductance and capacitance strain gauges because it is cheap and needs less technical skill. It consists of a grid of fine resistance wire (0.001 in. diameter) cemented to thin paper with a cellulose acetate adhesive. The material used for the resistance wire is often "Ferry" (56 per cent. Cu, 44 per cent. Ni) or "Brightray" (80 per cent. Ni, 20 per cent. Cr). The grid may be formed by space-winding the fine wire to and fro in the plane of the gauge. Alternatively the fine wire may be space-wound as a helix on a cylindrical former, which is first covered with a thin paper sleeve; a slight taper on the former simplifies the removal of the tubular paper sleeve and helical coil, which is then squeezed flat.

The resistance of the wire is given by

$$R=\rho_1 l/a_1$$

and it follows that the change ΔR in its resistance owing to its change in dimensions under tension is

$$\Delta R=(\partial R/\partial l)\Delta l+(\partial R/\partial a_1)\Delta a_1+ \\ +(\partial R/\partial \rho_1)\Delta \rho_1 .$$

But

$$\partial R/\partial l=\rho_1/a_1=R/l$$
$$\partial R/\partial a_1=\rho_1 l/a_1{}^2=-R/a_1$$
$$\partial R/\rho_1=l/a_1=R/\rho_1.$$

Substituting and dividing by R

$$\Delta R/R = \Delta l/l - \Delta a_1/a_1 + \Delta\rho_1/\rho_1 .$$

But

$$\Delta a_1/a_1 = -2\sigma\Delta l/l$$

and therefore

$$\Delta R/R = (1+2\sigma)\,\Delta l/l + \Delta\rho_1/\rho_1 .$$

The strain $e = \Delta l/l$, so the strain sensitivity of the wire (or gauge factor as it is often called) is

$$s = (\Delta R/R)/e = 1 + 2\sigma + (\Delta\rho_1/\rho_1)/e .$$

Because of the lack of data on Poisson's ratio for fine wires and on the variation of ρ_1 with e, the gauge factor cannot be calculated from this equation, but must be determined by calibration, usually by attachment to a beam so loaded that it is subjected to a constant bending moment.

For static or slowly changing strains the strain gauge is connected in one arm of a D.C.-energised Wheatstone bridge. To secure temperature compensation a matched strain gauge, which is attached to an unstrained piece of the same material close to the active gauge, is connected in an adjacent arm of the bridge. If the specimen is being subjected to bending, both the gauges can be active, one being attached to the tension side and

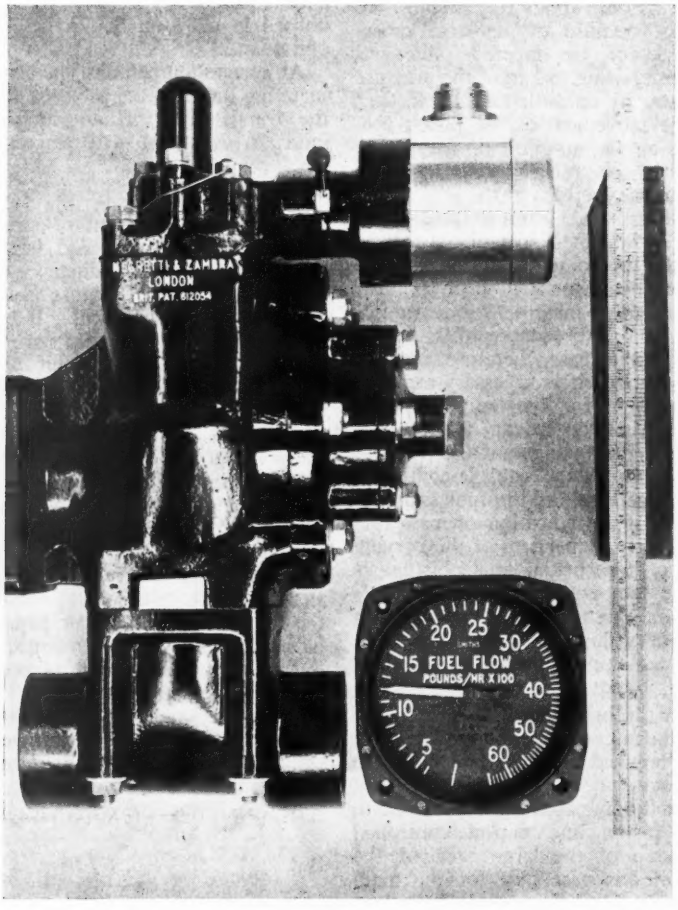


Fig. 11.
Negretti and Zambra fuel flowmeter.

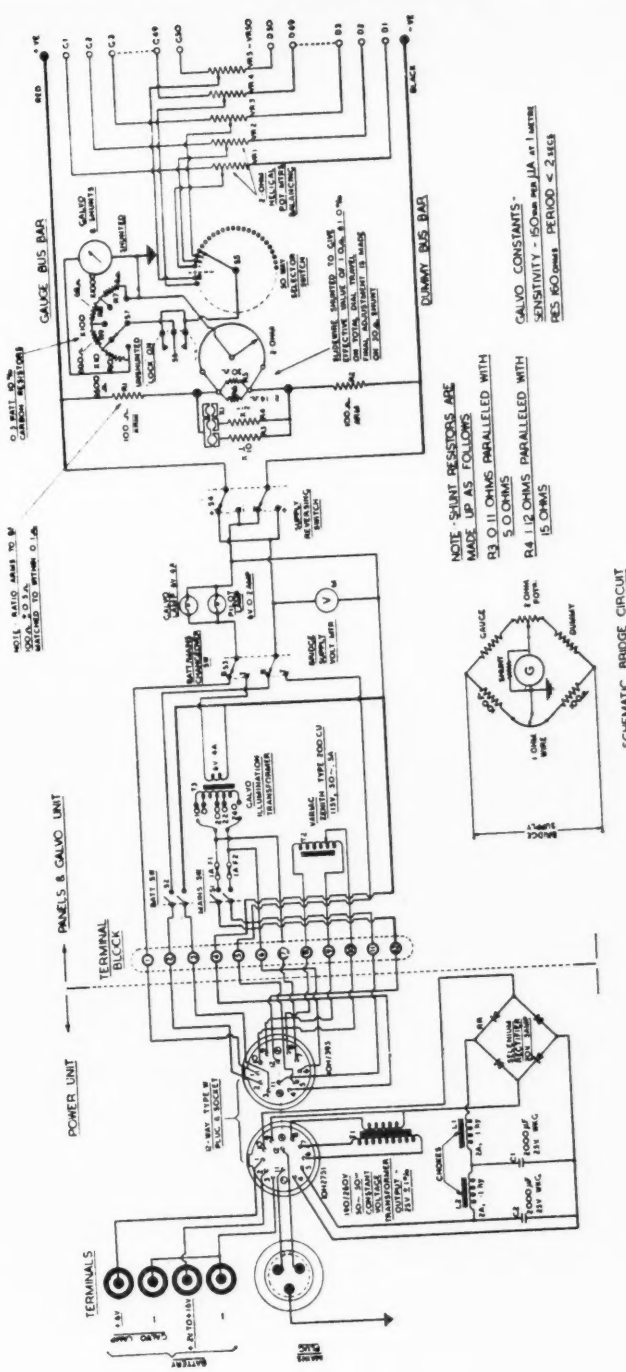

POWER UNIT
PANELS & GALVO UNIT
TERMINAL BLOCK
TERMINALS
GAUGE BUS BAR
DUMMY BUS BAR
SCHEMATIC BRIDGE CIRCUIT
NOTE SHUNT RESISTORS ARE MADE UP AS FOLLOWS
R3 0.11 OHMS PARALLELED WITH 5.0 OHMS
R4 1.12 OHMS PARALLELED WITH 15 OHMS
GALVO CONSTANTS -
SENSITIVITY - 150 mm per μA at 1 METRE
RES 150 OHMS PERIOD < 2.5 SECS

Fig. 12.
50-way strain indicator circuit.

the other to the compression side, thus securing twice the output from the bridge, as well as temperature compensation. An adjustable potentiometer is connected between the junction of the pair of gauges for preliminary balancing of the bridge. The resistance change due to strain is then indicated by a galvanometer or micro-ammeter connected in the usual way to measure the out-of-balance current or, using a null-reading method, by the position of a moving contact on a calibrated slide wire connected between the other two arms of the bridge.

Since static strains often have to be measured at a great many points simultaneously, for example during the loading of aircraft structures in ground test rigs, it is necessary to provide equipment with which the strain gauges can be connected quickly in turn to indicating or recording instruments. In one 50-way indicator (Fig. 12) the D.C.-energised bridge is made up of the active strain gauge, dummy strain gauge and two fixed arms of 100 ohms each. The bridge is balanced initially by means of a 2-ohm helical potentiometer connected between the two strain gauges. A calibrated slide wire of one ohm resistance is connected between the two fixed arms so that change in the resistance of the active gauge may be determined by moving the contact on the slide wire to re-balance the bridge. The use of this null method permits a 50-way switch to be inserted in the galvanometer circuit so that it may be connected to the moving contact of any one of 50 helical potentiometers and their associated strain gauges, active and dummy.

The galvanometer, which is of the D'Arsonval moving-coil type, has a resistance of 160 ohms. Its sensitivity is 150 mm./microamp, the mirror system in the equipment providing the required effective scale distance of one metre. The galvanometer sensitivity can be reduced 10, 100 and 1,000 times by a shunt selector switch. The shunt is designed always to present the galvanometer with a resistance equal to that necessary for critical damping. The galvanometer has a periodic time of less than two seconds.

The palladium-silver slide wire is wound on a 9-inch former as a single turn, which is given a slight lead so that it travels across the face of the platinum-gold-silver contact as the latter is rotated through 300° by a friction drive. The actual resistance of the slide wire is 2 ohms, which a shunt reduces to an effective value of one ohm. The 9-inch dial is calibrated from 0 to one per cent. (percentage change in resistance of active gauge) with long and short scale marks at intervals of 0.1 per cent. and 0.01 per cent. respectively. Shunts giving scale ranges of 0.5 per cent. or 0.1 per cent. may be added for easier reading of small changes in resistance of the active gauge.

The equipment (Fig. 13) requires a 200 to 250 volt A.C. supply. Its power pack provides a continuously variable 0 to 20 volt D.C. source for energisation of the bridge; this D.C. source is stabilised within ± 1 per cent. for ± 10 per cent. fluctuation in the mains supply. A separate tapped transformer is provided for the galvanometer lamp. The power pack can be cut out if desired and the equipment can be operated from an external battery.

The accuracy with which the percentage change in the resistance of the active gauge can be determined with this equipment is ± 0.005. This corresponds to $\pm \frac{1}{2}$ scale division, ± 1 scale division and ± 5 scale divisions on the three scale ranges.

In another equipment a motor driving a chart through a recorder also drives a mechanical rotary switch, which selects, in succession at the rate of about one a second, the output from 96 pre-balanced strain gauge bridges and feeds it to a D.C. amplifier with a gain of 10^5, the output being applied to the pen of the recorder to give full-scale deflection for 0.1 per cent. change in resistance of the strain gauge. When the 96 gauge points have been recorded, the motor can be reversed to run the chart back to the beginning of the record, and the phasing of the recording and switch drives adjusted so that, when the gauge points are next scanned at an increased loading of the structure, the record overlaps that previously made. The paper speed is such that ten such overlapping records can be made; the presentation of the record in this form has the advantage that departure from stress-strain linearity can be detected immediately. Another advantage is that the readings in repeated loading tests can be compared immediately. The equipment operates from a 230 volt 50 cycles/sec. supply.

This and other strain recorders are not inherently as accurate as the manually-operated strain indicator but they do avoid

Fig. 13.
50-way strain indicator.

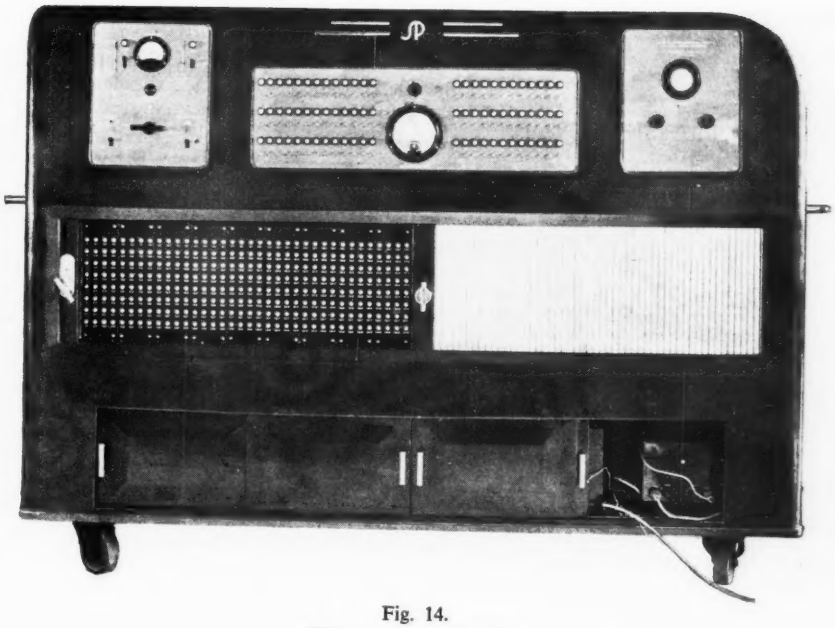
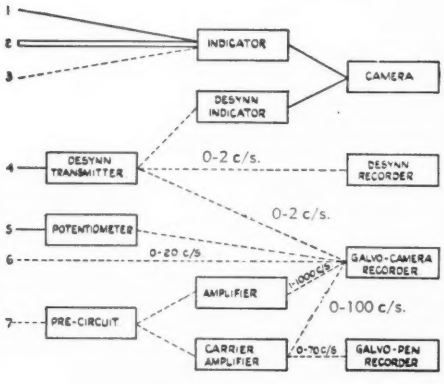


Fig. 14.
600-way strain recorder.

fatigue of the operator, and consequently inaccuracy, when many measurements have to be made quickly, *e.g.* when the structure is approaching failure.

With a third equipment (Fig. 14) 600 static strains can be recorded in about 10 seconds. The reduction in the time taken to obtain the measurements is offset, however, by the greater time taken to analyse the results. Only if the number of gauge positions is greater than 250 will the use of this automatic recorder show a saving in total time, for measurement and analysis, over the use of a number of manually-operated 50-way indicators. However, since each equipment needs two operators the choice of 50-way, 96-way or 600-way may depend on the staff available.

The strain gauge bridges are arranged in groups of eight, and the bridge output signals are selected three groups at a time, by a 24-pole 25-way selector switch and scanned by a single-pole 24-way high-speed rotary switch. A contact made every fourth revolution of the rotary switch moves the selector switch on one step so that the 600 bridge output signals are scanned in 100 revolutions of the rotary switch. The signals are passed on from the rotary switch, through a D.C. amplifier, to one pair of deflecting plates of a cathode ray tube and the deflection of the luminous spot on the screen is recorded on a continuously moving photographic film. The equipment operates from a 230-volt 50 cycles/sec. supply and includes a 24 D.C. rectified supply for the switches and film motor; 12-volt batteries are needed for energising the strain gauge bridges.



Recording methods.

mechanical connection
pneumatic connection
electrical connection

Fig. 15.

4. DATA TRANSMISSION

The choice of means for transmitting data from the measuring element to the recording equipment depends on the speed at which the physical quantity to be measured is changing in value. If it is so high that, as explained in Section 2, the variation in the physical quantity must be converted to a voltage variation, the problem is not one of transmission but of amplification.

Where the physical quantity is changing in value so slowly that sufficient output can be obtained from the measuring element to operate a recorder without interposing amplification, then the choice of transmission system is governed by the effect, on the accuracy of the measuring element, of the torque imposed by the transmitter.

Where the relatively high load imposed by the transmitter is acceptable the Smith Desynn system has been widely used because the transmitter and receiver are of simple design, the misalignment torque is high and it is a self-synchronising system, *i.e.* it cannot get out of step.

The development by Sangamo-Weston of a ratiometer with a scale length of 270°, instead of 90°, has removed one of the principal objections to the use of this system for data transmission. The simplicity of the transmitter, which moreover has only one rubbing contact, and the need for only three connecting wires between transmitter and receiver are advantages which may lead to its use rivalling that of the Desynn system, despite the disadvantages that (*i*) the receiver is more complex and must, because of its lower misalignment torque, have jewelled bearings, (*ii*) two receivers cannot be operated from one transmitter.

5. RECORDING

In testing aeroplanes, aircraft structures and aero-engines it is often necessary to record many varying quantities simultaneously. The methods employed in flight (Fig. 15) depend on the signal frequency

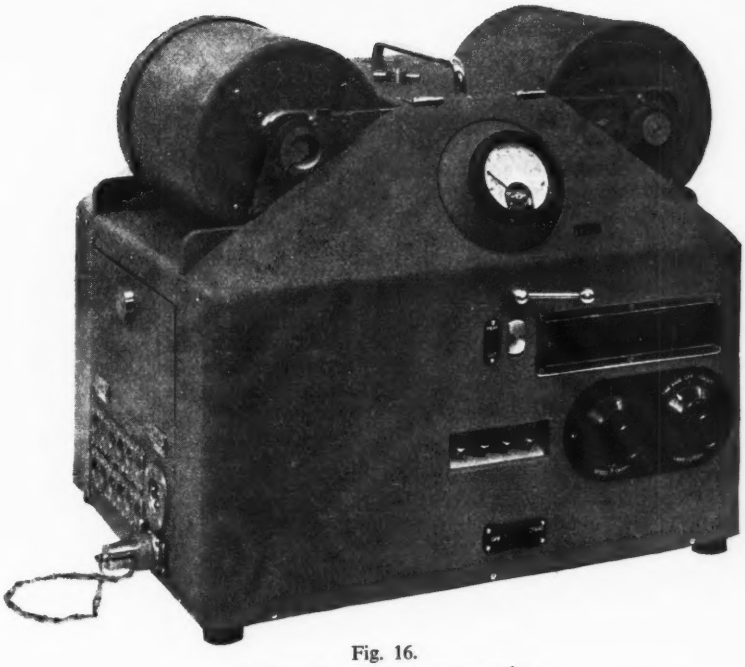


Fig. 16.
12-channel galvo-camera recorder.

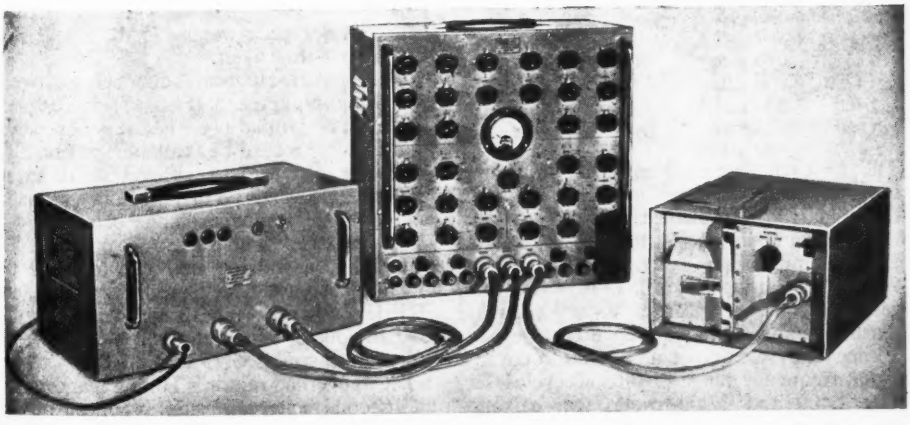


Fig. 17.
Four-channel direct recording equipment.

range to be covered. A continuous trace may be secured by the following means:—

(*a*) zero to 2,000 cycles/sec. by galvo-camera

(*b*) zero to 70 cycles/sec. by galvo-pen

(*c*) zero to 2 cycles/sec. by Desynn recorder.

If an intermittent record will suffice, because the physical quantities are changing only slowly in value and the tedium of tabulating dial readings from photographs can be tolerated, then it may be secured at intervals, slower than 4 per second, with a pulsed single-shot camera or at speeds up to 64 per second with a ciné camera.

The R.A.E.-Films and Equipment 12-channel galvo-camera recorder (Fig. 16) is designed for flight or ground use with or without amplification of the signals to be recorded. The recording is made on 6 in. wide photographic paper which is fed between two detachable cassettes accommodating 200 feet. Two ranges of speeds of paper transport are available, the lower being 0.5, 1.0, 2.5 and 5.0 in./sec. and the upper 5, 10, 25 and 50 in./sec.

Speeds within either range are selected by rotation of a knob; change of speed range is effected by interchanging two gears. The twelve galvanometer armatures can be removed easily and those of natural frequency appropriate to the signal frequencies to be recorded on the various channels can be substituted. The interchangeable galvanometer armatures available are :—

Natural frequency (cycles/sec.)	*Usable frequency range (cycles/sec.)*	*Sensitivity (milliamps/cm.)*	*Damping*
65	0 to 50	0.01	Back e.m.f.
130	0 to 100	0.05	Back e.m.f.
1,400	0 to 1,000	12	Silicone oil
3,000	0 to 2,200	120	Silicone oil

The 65 cycles/sec. galvanometer armatures may frequently be used to record unamplified signals, *e.g.* from thermo-couples, potentiometers, unbonded resistance pick-ups and Desynn transmitters modified for use as Wheatstone bridges. The 130 cycles/sec. galvanometer armatures have adequate sensitivity and frequency range for use with 2 kilocycles/sec. carrier amplifiers to cover a signal frequency range of 0 to 80 cycles/sec. The 1,400 and 3,000 cycles/sec. galvanometer armatures are suitable for use with vibration amplifiers of appropriate frequency range.

The time marking on the record is in the form of narrow transverse lines across the record at intervals of 0.01 sec., each tenth line being thicker; for the lower range of speeds, time marks at 0.1 sec. only can be arranged.

The weight of the recorder is 100 lb. and its dimensions are 16.5 in. high × 18 in. long × 15 in.

The R.A.E.-McMichael 6-channel A.C. bridge amplifier is used, in the frequency range 0 to about 80 cycles/sec., with resistance or inductance pick-ups whose impedance (at 2 kilocycles/sec.) is between 200 and 20,000 ohms, and a galvo-camera recorder fitted with galvanometer armatures having a natural frequency of 130 cycles/sec. The pick-up forms the part or whole of a bridge network energised by 10 volts r.m.s. alternating current of frequency 2 kilocycles/sec. The bridge unbalance voltage, amplitude modulated at the signal frequency, is amplified, demodulated in a phase-sensitive demodulator, and then passed to a directly-coupled output stage which feeds the galvanometer. A second type of amplifier, containing two optional stages of integration, is also available.

The overall sensitivity of the amplifier is such that a change of one part in 5,000 in one of the bridge arms produces a change in output current, in any resistance up to 1,000 ohms, of about 300 microamps. The output is proportional to resistance change within ± 1 per cent. up to a maximum output of one milliamp. This amplifier weighs 25 lb. and its size is 24 in. × 10½ in. × 10 in.; its associated power pack weighs 25 lb. and its size is 19 in. × 8 in. × 6½ in.

The R.A.E.-Hughes 4-channel galvo-pen recording equipment (Fig. 17) is designed for flight or ground use when it is imperative that a visible record be available immediately. It is intended for use with resistance strain gauges and resistance or inductance pick-ups in the signal frequency range of 0 to about 70 cycles/sec. The record is produced by employing a moving coil galvanometer to operate a stylus, which produces a trace on Teledeltos paper. The 3 inch wide chart in 300 ft. rolls is driven through a gear-box at alternative speeds of 5 and 15 cm./sec., by a D.C.-governed motor. Timing marks at 25 millisecond intervals are produced along both edges of the chart by two stationary styli, which are energised by a condenser discharge controlled by a strobotron, which,

in turn, is controlled by a phase-shift valve oscillator. The weight and dimensions of the equipment are

Recorder	32 lb.	10 in. × 7 in. × 13 in.
Power unit	31 lb.	16½ × 16 in. × 9 in.
Amplifier	28 lb.	8 in. × 8 in. × 18 in.

ACKNOWLEDGMENT

Acknowledgment is made by the author to the Chief Scientist, Ministry of Supply, for permission to publish this paper. Figs. 10 and 11 are reproduced with the permission of Negretti and Zambra Ltd.; the rest of the illustrations are Crown Copyright.

SUMMARY OF THE ACTIVITIES OF THE SOCIETY

JANUARY—DECEMBER 1951

THE following places on permanent record in the Journal, information which has appeared in the Monthly Notices and so summarises the activities of the Society for the year. Activities not reported in this Summary will be given in the Annual Report of the Council which will be published in the April 1952 JOURNAL.

ANNUAL GENERAL MEETING

The Annual General Meeting of the Society was held on Thursday, 10th May 1951 at 4 Hamilton Place, W.1, at 6 p.m. The following members were present:—

Major G. P. Bulman, President, in the Chair for the first part of the meeting.

Major F. B. Halford, President-elect, for the latter part of the meeting.

Mr. S. B. Bailey (*Associate Fellow*)
Dr. A. M. Ballantyne (*Associate Fellow*)
Mr. J. Bell (*Associate*)
Mrs. J. Bradbrooke (*Associate*)
Mr. P. W. Brooks (*Associate Fellow*)
Mr. M. C. Campion (*Graduate*)
Mr. R. H. Chaplin (*Fellow*)
Mr. S. A. Clark (*Associate Fellow*)
Mr. T. S. D. Collins (*Associate Fellow*)
Dr. H. Roxbee Cox (*Fellow*)
Mr. E. B. Dove (*Associate*)
Mr. J. A. Dunsby (*Graduate*)
Mr. R. Hadekel (*Associate Fellow*)
Mr. N. J. Hancock (*Associate Fellow*)
Mr. R. E. Hardingham (*Fellow*)
Mr. J. Housego (*Graduate*)
Mr. G. Ingram (*Associate*)
Mr. H. A. Jarrett (*Associate Fellow*)
Mr. L. W. Johnson (*Associate Fellow*)
Mr. E. T. Jones (*Fellow*)
Mr. C. V. Lane (*Associate Fellow*)
Mr. P. G. Masefield (*Fellow*)
Sir Frederick Handley Page (*Hon. Fellow*)
Mr. N. E. Rowe (*Fellow*)
Mr. R. H. Schlotel (*Fellow*)
Mr. N. Simmons (*Associate Fellow*)
Wing Cdr. H. Sims (*Associate*)
Mr. W. Tye (*Fellow*)
Mr. C. F. Uwins (*Fellow*)
Capt. C. Ward (*Associate*)

In attendance: The Secretary and Miss Barwood.

1. The Secretary read the Notice convening the Meeting.
2. Major G. P. Bulman, the President, said that before the business on the Agenda he wished to refer to the great loss sustained by the Society in the death of Mr. W. G. A. Perring, a member of Council for some years and a member of a number of Committees.
3. The Report of the Council on the state of the Society and the Balance Sheets of the Royal Aeronautical Society and Aeronautical Trusts Limited for the year ended 31st December 1950, which were published in the April 1951 JOURNAL, were presented. The President drew attention to some of the outstanding items in the Report, including the steady growth in membership, the active state of the Branches, 20 of which he had visited, and the Future Policy Committee.

   The Future Policy Committee had been set up during the year as a purely advisory Committee. The Technical Committee as such had ceased, but arising out of its report the Council had defined the Secretary's responsibilities for the execution of work on the Data Sheets.

The President then reported on the appointment of Dr. A. M. Ballantyne as the new Secretary. The Council had great difficulty in finding anyone of sufficient ability to take the place of Captain Pritchard but fortunately members need not say goodbye to Captain Pritchard as, although Dr. Ballantyne would take over the Secretaryship on 2nd July, Captain Pritchard would remain to organise the Anglo-American Aeronautical Conference in September. Captain Pritchard had visited America in the early part of the year to investigate the organisation from the American side.

4. Mr. N. E. Rowe, *Fellow*, said that as Chairman of the Branches Committee he would like to take the opportunity to say how greatly the Branches had appreciated the efforts of the President, showing them by his presence the place the Society gave as a whole to the Branches.

5. As a result of the ballot the President reported the following nominations to fill the vacancies on the Council:—

Air Commodore F. R. Banks (*Fellow*)	Dr. E. S. Moult (*Fellow*)
Mr. E. B. Dove (*Associate*)	Mr. W. E. W. Petter (*Fellow*)
Mr. G. H. Dowty (*Fellow*)	Mr. J. G. Roxburgh (*Graduate*)
	Mr. W. Tye (*Fellow*)

6. The President read the names of those proposed for *Fellowship* and passed by the Council as follows:—

A. D. Baxter	E. Mensforth
H. T. Chapman	F. W. Page
L. Howarth	M. Roy
M. S. Kuhring	D. Williams
M. J. O. Lobelle	A. D. Young
J. Martin	

7. It was agreed that Messrs. Price Waterhouse be re-appointed Auditors for the ensuing year for the Royal Aeronautical Society and Aeronautical Trusts Limited.

8. Mr. P. G. Masefield, *Fellow*, said he was sure those present would wish to pass a Vote of Appreciation to the staff for their work during the year, and to couple with that vote the name of Captain Pritchard. He had borne on his shoulders the work of the Society for many years and it was going to be difficult to achieve such loyalty to such a high degree. Captain Pritchard had been an ideal Secretary for a body such as theirs.

Mr. Masefield said he would like to couple his remarks with a hearty welcome to Dr. Ballantyne and said the Council would do all they could to help him in the difficult job he had. This vote was seconded by Mr. Rowe.

9. Captain Pritchard said he would like to thank the meeting very much for their kind remarks. He was glad to leave in one sense; he had been there a great many years and seen the work of the staff. He said a man was not good by himself but the results of his work were shown by the people around him, the President and Council and members of the Society, and particularly the staff who were so loyal to their jobs.

10. Major Bulman said nothing remained for him but to hand over to his successor, Major F. B. Halford. The Presidency had been a very heavy load but he had enjoyed his term of office immensely and found people extremely kind. Throughout his year of office he had tried to stress the human side as opposed to contributing to the technical side. He now handed over to an old friend. He wished him the best of luck and was sure he would make a fine President.

11. Major Halford said he was deeply honoured by the Council electing him as President. The Society would have two "new boys" this year, Dr.

Ballantyne as Secretary and himself as President. He would like to congratulate Major Bulman on his peregrinations through the Branches during his term of office. Major Halford said he appreciated his limitations but he knew he was fortunate in having such good friends on the Council and among the staff.

12. Dr. Roxbee Cox, proposing a vote of thanks to the out-going President, said that all who had worked with Major Bulman greatly appreciated his work as President. It was a job well done.

HONOURS

The following members of the Society received medals in 1951:—

NEW YEAR HONOURS—JANUARY 1951

ORDER OF MERIT

Marshal of the Royal Air Force The Rt. Hon. Hugh Viscount Trenchard (*Honorary Fellow*)

G.C.B.

Air Chief Marshal Sir James Milne Robb (*Associate Fellow*)

K.C.B.

H. M. Garner (*Fellow*)

C.B.E.

Acting Air Vice-Marshal T. N. McEvoy (*Associate Fellow*)
H. Constant (*Fellow*)
J. E. Serby (*Fellow*)

M.B.E.

P. R. Allison (*Associate Fellow*)
J. C. C. Taylor (*Associate*)

A.F.C.

S/Ldr. R. A. Watts (*Associate Fellow*)

BIRTHDAY HONOURS—JUNE 1951

C.B.E.

H. T. Chapman, *Fellow*; G. W. H. Gardner, *Fellow*; W. E. W. Petter, *Fellow*.

O.B.E.

H. E. Hancocke, *Associate Fellow*.

A.F.C.

S./Ldr. A. E. Callard, *Associate*; Cdr. (E) P. S. Wilson, *Associate Fellow*.

M.B.E.

G. Maclaren Humphreys, *Associate Fellow*.

INSTITUTE OF THE AERONAUTICAL SCIENCES

Sir Henry Tizard, *Fellow*, was awarded Honorary Fellowship of the Institute of the Aeronautical Sciences. Only one such award is made in the year to a non-American.

WRIGHT BROTHERS MEMORIAL TROPHY

Professor J. C. Hunsaker, *Honorary Fellow*, was awarded the Wright Brothers Memorial Trophy for 1951 in appreciation of his long career in aviation public service.

WRIGHT BROTHERS MEDAL

Mr. James C. Floyd, *Associate Fellow*, was awarded the Wright Brothers Medal of the Society of Automotive Engineers.

THE DANIEL GUGGENHEIM MEDAL

The Guggenheim Medal for 1950 was awarded to Dr. H. L. Dryden, *Fellow*, for his outstanding leadership in aeronautical research and fundamental contributions to aeronautical science.

For 1951 it was awarded to Mr. Igor Sikorsky "for a lifetime of outstanding contributions to aeronautics, including pioneering with multi-engine aeroplanes, flying boats, amphibians and helicopters."

THE GOLD MEDAL OF THE F.A.I.

The Gold Medal of the Federation Aéronautique Internationale was awarded to Air Commodore Sir Frank Whittle, K.B.E., C.B., C.B.E., M.A., D.Sc., F.R.S., *Fellow*.

INSTITUTE OF NAVIGATION GOLD MEDAL

The Gold Medal for 1950-51 of the Institute of Navigation has been awarded to Mr. H. C. Pritchard, *Fellow*, for valuable contributions in the field of airborne navigation.

THE KELVIN MEDAL

The Kelvin Medal, 1950, was presented to Dr. Theodore von Kármán, *Hon. Fellow*, of the California Institute of Technology, by the Institution of Civil Engineers, on Tuesday 6th November 1951.

CITY AND GUILDS INSTITUTE

Mr. S. Scott Hall, C.B., M.Sc., D.I.C., *Fellow*, was awarded Fellowship of the City and Guilds Institute.

GUILD OF AIR PILOTS AND AIR NAVIGATORS OF THE BRITISH EMPIRE

Mr. J. Lankester Parker, O.B.E., *Fellow*, was elected Master of the Guild of Air Pilots and Air Navigators on 12th April 1951.

THIRD ANGLO-AMERICAN AERONAUTICAL CONFERENCE

The Third Anglo-American Aeronautical Conference, convened jointly by the Royal Aeronautical Society and the Institute of the Aeronautical Sciences, was held in Brighton from the 3rd-7th September. It was attended by 100 American Delegates and more than 400 British Delegates and by 40 American and 150 British ladies. Twenty papers were given at the Technical Sessions, ten by Americans, eight by British members, one by an Australian and one by a Canadian.

An account of the Conference was published in the November Journal.

ELECTION OF THE PRESIDENT AND VICE-PRESIDENTS

Major F. B. Halford, C.B.E., *Fellow*, was elected President of the Society for 1951-52 and took office at the Annual General Meeting on the 10th May 1951.

The following were elected Vice-Presidents of the Society for 1951-52 at the Meeting of Council held on 24th May 1951:—

S. Camm, C.B.E., *Fellow*
G. H. Dowty, *Fellow*
G. R. Edwards, M.B.E., B.Sc., *Fellow*

THE SECRETARY

Dr. A. M. Ballantyne, B.Sc., T.D., A.F.R.Ae.S., A.M.I.C.E., A.M.I.Struct.E., took over his duties as Secretary of the Society on Monday, 2nd July 1951. A photograph of Dr. Ballantyne and an account of his career were published in the October Journal.

Captain J. L. Pritchard, C.B.E., Hon.F.R.Ae.S., Hon. F.I.Ae.S., who had been Secretary of the Society since 1925, was responsible for the organisation of the Third Anglo-American Aeronautical Conference, which was held in September.

HONORARY FELLOWSHIP

The following were awarded Honorary Fellowship of the Society in 1951:—

Professor Sir Melvill Jones
Sir Henry Tizard
C. C. Walker

MEDALS AND AWARDS

The Society's Gold Medal—the highest honour the Society can give for work of outstanding merit in aeronautics was awarded posthumously to Mr. W. G. A. Perring, C.B., *Fellow*, for his distinguished services to aeronautical science.

The Society's Silver Medal—for work of an outstanding nature in aeronautics, was awarded to S. B. Gates, *Fellow*, Deputy Chief Scientific Officer, Royal Aircraft Establishment, for his work on the stability and control of aircraft.

The Society's Bronze Medal—for work leading to advancement in aeronautics, was awarded to H. J. Pollard, *Fellow*, Divisional Director, Aircraft, The Bristol Aeroplane Co. Ltd., for his many contributions to the development of aircraft construction.

The British Gold Medal—for practical achievement leading to advancement in aeronautics, was awarded to A. E. Russell, *Fellow*, Director and Chief Designer, The Bristol Aeroplane Co. Ltd., in recognition of his achievements in aircraft design.

The British Silver Medal—for practical achievement leading to advancement in aeronautics, was awarded to Group-Captain John Cunningham, Chief Test Pilot, The de Havilland Aircraft Co. Ltd., for his outstanding work as a test pilot.

The George Taylor (of Australia) Gold Medal—for the most valuable paper read before the Society during the previous session, was awarded to R. E. Bishop, *Fellow*, Director, The de Havilland Aircraft Co. Ltd., for his paper on "Design for Maintenance."

The Simms Gold Medal—for the most valuable contribution read before, or received by, the Society on any subject allied to aeronautics, was awarded to Dr. G. S. Hislop, *Associate Fellow*, Senior Assistant to the Controller of Research, British European Airways, for his paper on "Clear Air Turbulence Over Europe."

The Herbert Ackroyd Stuart Memorial Prize—for the most valuable contribution read before, or received by, the Society on Applied Thermodynamics, was awarded to A. V. Cleaver, *Associate*, Special Projects Engineer, The de Havilland Engine Co. Ltd., for his paper on "Rockets and Assisted Take-off."

The Edward Busk Memorial Prize—for the most valuable contribution read before, or received by, the Society on Applied Aerodynamics, was awarded to R. Hills, *Associate Fellow*, Principal Scientific Officer, Royal Aircraft Establishment, for his paper on "The Use of Wind Tunnel Model Data in Aerodynamic Design."

The Orville Wright Prize—for the best contribution on some subject of a technical nature in connection with aeronautics published in "The Aeronautical Quarterly," was awarded to Dr. S. Neumark, Aerodynamics Department, Royal Aircraft Establishment, for his paper on "Critical Mach Numbers for Swept-Back Wings" ("The Aeronautical Quarterly," Volume II, Part II, August 1950).

The R. P. Alston Memorial Prize—for practical achievement associated with the flight testing of aircraft, was awarded to R. J. Falk, A. V. Roe & Co. Ltd., for his work on delta wing aircraft.

ROYAL AERONAUTICAL SOCIETY CHARTER SCHOLARSHIP

The Charter Scholarship for 1951-1952 was awarded to Thomas E. B. Bateman.

THE GEOFFREY DE HAVILLAND MEMORIAL SCHOLARSHIP

The Geoffrey de Havilland Memorial Scholarship for 1951-1952 was awarded to Ian Douglas Neilson.

ELLIOTT MEMORIAL PRIZE

The Elliott Memorial Prize was awarded to Aircraft Apprentice T. L. Cox, of the May 1948 Entry at R.A.F., Halton, who obtained the highest marks in the General Studies Examination; to Sergeant Aircraft Apprentice D. Allison, of the September 1948 Entry at R.A.F., Halton, who obtained the highest marks in the General Studies Examination; and to Sergeant Aircraft Apprentice R. Greenwood, of the January 1949 Entry at R.A.F., Halton, who obtained the highest marks in the General Studies Examination.

JOURNAL PREMIUM AWARDS

The following Premium Awards were made in 1951 for papers published in the JOURNAL during 1950:—

H. L. Cox and E. P. Coleman for their paper on Note on Repeated Loading Tests on Components and Complete Structures, Fifteen Guineas. January 1950 JOURNAL.

Dr. P. B. Walker for his paper on Destructive Energy in Aircraft Pressure Cabins, Fifteen Guineas. April 1950 JOURNAL.

D. R. H. Dickinson for his paper on Prototype Testing of Aircraft, Fifteen Guineas. June 1950 JOURNAL.

C. H. Latimer-Needham for his paper on Flight Refuelling and the Problem of Range, Fifteen Guineas. July 1950 JOURNAL.

W. E. Thornton-Bryar for his paper on Elementary Aspects of Technical Statistics and Common Fallacies—with Examples on Measurement of Aero Engine Reliability, Fifteen Guineas. July 1950 JOURNAL.

Professor A. D. Young for his paper on The Drag Effects of Roughness at High Subcritical Speeds, Fifteen Guineas. August 1950 JOURNAL.

C. H. Jackson for his paper on Some Aspects of Air Safety, Fifteen Guineas. September 1950 JOURNAL.

C. J. Moss for his paper on Redux Bonding of Aircraft Structures, Fifteen Guineas. October 1950 JOURNAL.

S. C. Ghose for his paper on A Comparative Study of the Noise from Turbo-Jet and Reciprocating Aircraft Engines in Flight, Fifteen Guineas. November 1950 JOURNAL.

H. Giddings for his paper on Aircraft Riveting, Fifteen Guineas. December 1950 JOURNAL.

GARDEN PARTY, 6th MAY 1951

The Society's Annual Garden Party was held on Sunday, 6th May 1951 at White Waltham Aerodrome, near Maidenhead, from 2.30 p.m. to 6.30 p.m. An account of the Garden Party was given in the July JOURNAL.

39th WILBUR WRIGHT MEMORIAL LECTURE

The 39th Wilbur Wright Memorial Lecture was given on 10th September 1951 by Mr. A. E. Raymond, of the Douglas Aircraft Corporation, California, on "The Well-Tempered Aircraft." The complete report was published in the October 1951 JOURNAL. Following the lecture a reception was held in the offices of the Society.

FOURTH LOUIS BLERIOT LECTURE

The Fourth Louis Bleriot Lecture was given on 23rd February 1951 by Monsieur Maurice Roy on "Power versus Weight in Aviation." The complete report was published in the May 1951 JOURNAL.

SEVENTH BRITISH COMMONWEALTH AND EMPIRE LECTURE

The Seventh British Commonwealth and Empire Lecture on " Air Transport in New Zealand and the South Pacific " by Air Vice-Marshal Sir Leonard Isitt, K.B.E., R.N.Z.A.F., of New Zealand, was given on 4th October 1951. In the absence of Sir Leonard Isitt the paper was read by Mr. T. A. Barrow, J.P. The complete report was published in the November 1951 JOURNAL.

LECTURES 1951

MAIN LECTURES (at the Institution of Civil Engineers, unless otherwise stated)

15th February—AT COVENTRY—Some Aspects of Flight Research, Handel Davies, M.Sc., F.R.Ae.S.

23rd February—Fourth Louis Bleriot Lecture. Power versus Weight in Aviation, M. Roy.

1st March—Progress Towards Electrical Serviceability, R. H. Woodall, A.F.R.Ae.S., and V. A. Higgs.

15th March—Progress Towards Hydraulic Serviceability, H. G. Conway, M.A., M.I.Mech.E., F.R.Ae.S., and R. H. Bound, F.R.Ae.S.

29th March—Some Aspects of Modern Naval Aircraft Design, D. L. Hollis Williams, B.Sc., F.R.Ae.S.

12th April—Planning and Production Methods as Applied to the Comet, H. Povey, A.F.R.Ae.S.

26th April—A DISCUSSION. Air Travel from the Passenger's Point of View.

10th September—39th Wilbur Wright Memorial Lecture, The Well-Tempered Aircraft, A. E. Raymond.

4th October—Seventh British Commonwealth and Empire Lecture, Air Transport in New Zealand and the South Pacific, Air Vice-Marshal Sir Leonard Isitt, K.B.E., R.N.Z.A.F. (ret'd.).

18th October—Modern Trends in Civil Airworthiness Requirements, W. Tye, O.B.E., F.R.Ae.S. (at the Institution of Mechanical Engineers).

1st November—FILMS associated with Mr. E. G. Stout's lecture to the Third Anglo-American Conference on, A Review of High-Speed Hydrodynamic Development.

22nd November—AT CHELTENHAM—Problems of Transonic Flight, A. N. Clifton, F.R.Ae.S.

29th November—Structural Problems in Advanced Aircraft, H. H. Gardner, F.R.Ae.S.

6th December—Air Intakes for Gas Turbines, J. Seddon, Ph.D., A.F.R.Ae.S.

20th December—Control Surface Flutter, H. G. Broadbent, A.F.R.Ae.S., and W. T. Kirkby.

SECTION LECTURES (at 4 Hamilton Place, W.1)

30th January—Development of Cabin Superchargers and Cooling Equipment for Civil Aircraft, W. D. L. Theed.

13th February—Derivation and Estimation of Aerodynamic Loads for Stressing Purposes, D. J. Lambert, A.F.R.Ae.S.

27th February—Development in Aircraft Wheels, Tyres and Brakes, J. Wright, F.R.Ae.S.

6th March—Problems of Pilot Ejection Seats, J. Martin, O.B.E.

10th April—Simulators, W. R. Thomas, B.Sc., A.M.I.E.E.

9th October—Power Operated Controls, C. F. Joy, A.F.R.Ae.S.

23rd October—Some Aspects of Design and Manufacture for Limited Production, W. S. Hollyhock, A.F.R.Ae.S.

30th October—Supersonic Propellers, Dr. W. F. Hilton, A.F.R.Ae.S.

27th November—Is it possible to Simplify Aircraft and still Maintain their Efficiency? W. S. Farren, F.R.Ae.S.

GRADUATES' AND STUDENTS' SECTION

The Graduates' and Students' Committee of Council for the year June 1951 to June 1952 is as fellows:—

Chairman—J. G. Roxburgh, *Graduate*.

Hon. Secretary—M. C. Campion, *Graduate*.

Committee Members—S. Scott Hall, *Fellow*; A. V. Cleaver, *Associate*; M. K. Bowden, *Graduate*; J. R. Cownie, *Student*; J. W. F. Housego, *Graduate*; F. G. Irving, *Graduate*; M. Prizeman, *Student*.

LECTURES (at 4 Hamilton Place, W.1)

25th January—Campaigning in Korea, William Courtenay, O.B.E., M.M., A.R.Ae.S.

8th March—Practical Design for High M_{CRIT}, G. H. Lee, B.Sc., D.I.C., A.R.C.S., F.R.Ae.S.

5th April—Model Tests in the R.A.E. Spinning Tunnel and the Prediction of Full Scale Spin Characteristics, D. J. Harper, B.Sc.(Eng.), A.F.R.Ae.S.

19th April—Boundary Layer Control, E. D. Poppleton, M.Sc.

11th October—Airships, Lord Ventry.

25th October—The A.B.C. of Stability, K. S. Lawson, *Graduate*.

6th November—Production Research for Aircraft, L. E. Bunnett, A.F.R.Ae.S.

11th December—Naval Aircraft, D. L. Hollis Williams, F.R.Ae.S.

RECEPTION

A Reception and Dance was held by the Graduates' and Students' Section at the offices of the Society on the 9th November. Members and guests were received by Mr. J. G. Roxburgh, Chairman of the Graduates' and Students' Committee.

During the evening films were shown.

BRANCH LECTURES AND ACTIVITIES

BELFAST BRANCH

16th January—Recent Developments in Landing Gear and Equipment, H. G. Conway, M.A., F.R.Ae.S.

27th February—Aircraft Carriers—Problems Associated with the Operation of Aircraft, J. L. Bartlett.

13th March—Radar—How it Works, B. W. Hodlin, B.Sc.

3rd April—Annual General Meeting.

BIRMINGHAM BRANCH

26th January—*Visit* to Goodyear Tyre Co. Ltd.

30th March—Radar, B. W. Hodlin, B.Sc.

27th April—Annual General Meeting.

15th September—*Visit* to Round Oak Steel Works.

12th October—Aeronautical Brains Trust: Professor S. C. Redshaw, F.R.Ae.S., G. Firkins, A. Yoxall, Ben Gunn.

20th November—*Visit* to Austin Motor Co. Ltd. at Longbridge.

BRISTOL BRANCH

8th January—Aircraft and Aero-Engine Vibrations, M. O. W. Wolfe, D.I.C. (Section Lecture.)

15th January—The Development of the Comet, R. E. Bishop, C.B.E., F.R.Ae.S.

30th January—The Aerodynamic Oscillation of Suspension Bridges, R. A. Frazer, D.Sc., F.R.Ae.S., F.I.A.S.

14th February—Civil Engineering and Aeronautics, A. G. Pugsley, O.B.E., D.Sc., F.R.Ae.S.

27th February—Human Factors in the Design and Operation of Civil Air Transport Aircraft, Kenneth G. Bergin, M.A., M.D., D.P.H., A.F.R.Ae.S.
12th March—Junior Members' Papers Competition.
4th April—Power Plant Requirements for Future Aircraft, F. M. Owner, C.B.E., M.Sc., F.R.Ae.S., M.S.A.E.
17th April—Some Notes on Overhaul and Maintenance, C. H. Jackson, B.Sc., A.C.G.I., A.F.R.Ae.S., A.M.I.Mech.E.
30th April—Annual General Meeting and FILM Show.
3rd October—Some Applications of Radar in Aeronautics, H. R. Johnston, B.Sc., A.M.I.E.E.
24th October—Civil Aviation; its Present and Future, Peter G. Masefield, M.A., F.R.Ae.S., A.F.I.A.S., M.Inst.T.
14th November—Civil and Aeronautical Structural Test Methods, Professor S. C. Redshaw, M.Sc., Ph.D., F.R.Ae.S., M.I.C.E. (*Joint meeting with the Institution of Civil Engineers.*)
3rd December—Some Problems in the Development of Future Fighter Aircraft, P. W. Wreford-Bush, A.F.R.Ae.S.
18th December—Aeronautical Brains Trust. Question Master: N. E. Rowe, C.B.E., D.I.C., B.Sc., A.C.G.I., F.R.Ae.S.

BROUGH BRANCH

10th January—Problems of High-Speed Flight. H. Davies, M.Sc., F.R.Ae.S.
14th February—A Talk on Aero-Engines, Air Commodore F. R. Banks, C.B., O.B.E., F.R.Ae.S.
14th March—Aircraft Structures, P. B. Walker, M.A., Ph.D., F.R.Ae.S.
19th September—Radar, R. King.
31st October—The First Moon Rocket, E. Burgess.
21st November—The Probable Role and Influence of Aircraft in Future Warfare, Air Marshal Sir Robert H. M. Saundby, K.B.E., C.B., M.C., D.F.C., A.F.C., R.A.F.(Retired).
12th December—Thirty Years of Naval Aircraft Development, G. E. Petty, F.R.Ae.S., M.I.Mech.E.

CHESTER BRANCH

7th February—The Use of Wind Tunnels in Aeroplane Design, D. L. Ellis, B.Sc., A.R.T.C., F.R.Ae.S.
7th March—Undercarriages and Hydraulic Equipment, C. V. B. Neilson.
12th September—Helicopter Flight, W. Stewart, B.Sc.
5th October—Advances in Aeroplane Structural Design, G. T. R. Hill, M.C., F.R.Ae.S.
7th November—General Flying, Squadron Leader J. D. Derry, D.F.C.
4th December—Some Metallurgical Aspects of Engineering Design, L. Marshall, A.F.R.Ae.S., A.I.Mech.E., A.I.M.

COVENTRY BRANCH

15th February—25th Anniversary Lecture (Main Lecture of the R.Ae.S.)—Some Aspects of Flight Research, Handel Davies, M.Sc., F.R.Ae.S.
21st March—High Speed Air Flow, W. F. Hilton, Ph.D., A.F.R.Ae.S.
18th April—Annual General Meeting and FILMS.
3rd May—*Visit* to Fort Dunlop.
19th May—*Visit* to Coventry "Evening Telegraph."
2nd June—*Visit* to Mitchell's and Butler's Brewery.
29th June—*Visit* to the National Physical Laboratory.
17th October—Modern Methods of Testing Aero Engines, L. B. Hall.
21st November—The Problems of Integrally Stiffened Wing Structures, A. F. Newall, A.F.R.Ae.S.
19th December—FILM Evening.

DERBY BRANCH

1st January—The Design Requirements of Naval Aircraft, Lt. Cdr. (A) E. M. Brown, O.B.E., D.S.C., A.F.C., M.A., A.F.R.Ae.S.
5th February—Pressurising and Cabin Air Conditioning, W. M. Widgery, F.R.Ae.S.
12th March—The Cierva Air Horse, J. S. Shapiro, Dipl. Ing., A.F.R.Ae.S.
2nd April—The Evolution of the Design of a Jet Engine, A. A. Lombard, A.F.R.Ae.S.
7th May—Long Range Turbo-Jet Transport, A. E. Russell, B.Sc., F.R.Ae.S.
1st October—Astro-Physics in Relation to Space Travel, Fred Hoyle.
5th November—Three 10-minute papers, by H. N. Bailey, B.Sc., A.F.R.Ae.S., K. I. C. Vincent, B.A., and J. E. B. Perkins, B.Sc., D.I.C., and FILMS.
3rd December—The Aviation Engine, Air Commodore F. R. Banks, C.B., O.B.E., F.R.Ae.S., M.I.Mech.E.—*Joint meeting with the Derby Branch of the Institution of Mechanical Engineers.*

GLASGOW BRANCH

23rd January—Brains Trust.
22nd February—Thin Walled Structures, Dr. R. M. Kenedi, Ph.D., A.F.R.Ae.S., A.M.I.Mech.E.
22nd March—Gas Turbines, L. Haworth, B.Sc., A.M.I.Mech.E.

GLOUCESTER AND CHELTENHAM BRANCH

10th January (*Gloucester*)—The Design and Operation of Naval Aircraft, Lt. Cdr. E. M. Brown.
2nd February (*Cheltenham*)—Gliding, P. A. Wills, C.B.E.
28th February (*Cheltenham*)—FILMS.
3rd March—*Visit* to De Havilland's, Hatfield.
18th September (*Cheltenham*)—Flight Instruments, Preston R. Bassett, F.I.A.S.
27th September (*Cheltenham*)—FILMS.
24th October (*Gloucester*)—Some Production Problems in Building a Brabazon Aircraft, F. Chard, M.I.Prod.E.
22nd November (*Cheltenham*)—Problems of Transonic Flight (Main Society Lecture), A. N. Clifton, B.Sc., F.R.Ae.S.
12th December (*Gloucester*)—The Effect of Jet Engines on Aircraft Design, H. W. V. Steventon, A.F.R.Ae.S., M.I.Mech.E.

HALTON BRANCH

15th January—Helicopters. Films and Discussion, R. N. Liptrot, C.B.E., B.A.
22nd January—Flight Testing from the Pilot's Angle, Wing Cdr. P. G. Wykeham-Barnes, O.B.E., D.S.O., D.F.C.
29th January—Branch Night.
5th February—The Work of the Aerodynamics Division of the National Physical Laboratory, A. Fage, F.R.S., F.I.A.S., F.R.Ae.S.
19th February—FILMS.
21st February—*Visit* to National Physical Laboratory.
26th February—Cabin Air Control, Corporal Apprentice J. H. Ansley.
5th March—The Case for the Flying Boat, D. Keith-Lucas, F.R.Ae.S.
7th March—*Visit* to Air Trainers Ltd.
12th March—Aircraft Icing Problems, Corporal Apprentice F. L. Maitland-Titterton and Corporal Apprentice E. Davies.
19th March—Brains Trust.
21st May—Photography: Events Aerial and Otherwise.
29th May—Solo to Australia, Group Captain A. F. Bandidt.
11th June—FILMS.

18th June—Branch (Junior) Quiz.
23rd June—*Visit* to National Air Races
25th June—Helicopters.
2nd July—Branch (Junior) Quiz.
9th July—Debate: "The Development of the Modern Aircraft has gone too far for the Common Good."
23rd July—Some Aspects of Gas Turbines, C/A/A G. F. Poyser.
6th October—Debate: The Flying Boat is Outmoded. Guest Speakers: D. Keith Lucas, B.A., M.I.Mech.E., F.R.Ae.S., and A. E. Russell, B.Sc., F.R.Ae.S.

HATFIELD BRANCH

17th January— Discussion Evening.
31st January— Discussion Evening.
7th February— Discussion Evening.
17th October—The Life and Work of Colonel Cody, G. A. Broomfield.

ISLE OF WIGHT BRANCH

11th January—The Cierva Air Horse, J. S. Shapiro, Dipl. Ing., A.F.R.Ae.S.
25th January—Economic Aspects of Civil Aviation, P. G. Masefield, M.A., F.R.Ae.S.
22nd February—Interplanetary Flight—(The Rocket Engineer's Point of View), A. V. Cleaver, A.R.Ae.S.
8th March—Methods of Time Keeping, Dr. R. d'E. Atkinson.
22nd March—Junior Branch Prize Lectures.
4th October—The Fawley Oil Refinery: Lecture and FILM show.
18th October—Aeronautical Brains Trust.
15th November—Helicopters: Discussion and FILMS, K. Watson, A.F.R.Ae.S.
23rd November—Dinner Dance.
29th November—Operational Flying from Aircraft Carriers, Captain A. S. Bolt, D.S.O., D.S.C., R.N.
13th December—Annual General Meeting and FILMS.

LEICESTER BRANCH

24th January—Annual General Meeting and FILMS.
21st February—Welded Magnesium Aircraft Structures, R. J. Cross.
7th March—The Island Campaign (Coloured Film), W. Courtenay, O.B.E., M.M., A.R.Ae.S.
13th April—Rockets and Space Travel, J. Humphries, B.Sc., A.F.R.Ae.S., A.M.I.Mech.E.

LUTON BRANCH

24th January—FILMS—Steel Making and Usages (Thos. Firth and John Brown Ltd.).
7th February—Problems of Interplanetary Travel, A. C. Clarke, B.Sc., F.R.Ae.S.
7th March—De-Icing and Anti-Icing Systems, D. Rendel, B.Sc.
2nd May—Plastics in Aircraft, J. Byers.
23rd May—FILM Show and Discussion Evening.

MANCHESTER BRANCH

25th January—The Viscount Turbo-Prop. Aircraft, G. R. Edwards, M.B.E., B.Sc., F.R.Ae.S.
28th February—FILM: Steel Making and Usages (Thos. Firth and John Brown Ltd. and Firth-Vickers Stainless Steels Ltd.).
29th March—Cabin Air Conditioning, W. M. Widgery, F.R.Ae.S.
18th October—The Auto-Pilot and Its Development, A. I. O. Davies.

15th November—A Discussion: Electrics versus Hydraulics, E. R. Legg and H. G. Conway, F.R.Ae.S.
13th December—The Dart Engine, A. D. Jackson, A.F.R.Ae.S.

PRESTON BRANCH

28th March—Lecturettes.
25th April—Annual General Meeting.

PORTSMOUTH BRANCH—FILM Programme

4th January—Wood Screws to Wagon Wheels (Guest, Keen and Nettlefold Ltd.).
18th January—Plastics (De la Rue Insulation Ltd. and Bakelite Ltd.).
1st February—Stainless Steels (Firth Vickers Stainless Steels Ltd.).
15th February—"Pluto" and Welded Structures (Stewarts & Lloyds and Dorman, Long & Co. Ltd.).
1st March—Wood (CFL Film and Aims of Industry Film).
15th March—Casting and Forging Light Alloys (High Duty Alloys).
29th March—Annual General Meeting.
27th September—FILMS: Wonder Jet, Faster than Sound, Eagles of the Fleet, University of Flying.
11th October—The Life and Work of Colonel Cody, G. A. Broomfield.
24th October—FILMS: Wonders of the Deep, Charting the Seas, The Bristol Brabazon, Once upon a Time, and Down to Earth.
8th November—Testing Flying Boats, G. Tyson, A.F.R.Ae.S.
22nd November—FILMS: Buried Treasure, It comes from Coal, Radar goes to Sea, and Airscrew.
6th December—Branch Dinner and Brains Trust. Question Master: The Lord Mayor of Portsmouth, Alderman Albert Johnson, J.P. Brains Trust: A. Hessell-Tiltman, F.R.Ae.S., Professor E. J. Richards, F.R.Ae.S., and Thurston James.
20th December—FILMS: Flight Six, West Wind, The Gates of Power, New Town, and Contribution to Victory.

READING BRANCH

10th January—FILMS: Forging and Casting Techniques (High Duty Alloys).
14th February—FILMS: Mosquito Aircraft, Faster than Sound, Modern Aircraft Production (de Havilland Aircraft Co. Ltd. and Central Film Library).
14th March—Rigid Airships, Lord Ventry.

SOUTHAMPTON BRANCH

17th January—FILM Show.
21st February—Aircraft Undercarriages, R. C. Cussons, M.A.
21st March—The Further Development of the Brabazon Type, G. P. Hebden, B.Sc., A.F.R.Ae.S.
11th April—Instrumentation for Testing Aircraft and Aero-Engines, C. N. Jaques, B.Sc., A.F.R.Ae.S. (Joint meeting with Southern Branches of Institution of Mechanical Engineers and Institution of Electrical Engineers).
10th October—Wind Tunnels—Modern Technique and Practice, R. Hills, B.A., A.F.R.Ae.S.
31st October—Powered Aircraft Controls, D. J. Lyons, B.Sc., A.F.R.Ae.S.
28th November—Developments in Aircraft Production and Engineering, Professor J. V. Connolly, B.E., F.R.Ae.S.

WEYBRIDGE BRANCH

10th January—High Speed Flight, S/Ldr. J. D. Derry, D.F.C.
31st January—The Life and Work of Col. S. F. Cody, G. A. Broomfield.
21st February—Some Problems of Air Interception, Air Vice-Marshal T. G. Pike, C.B., C.B.E., D.F.C.

14th March—Turbine-Engined Aircraft, G. R. Edwards, M.B.E., B.Sc., F.R.Ae.S., A.M.I.Struct.E.
4th April—Gas Turbines, S. G. Hooker, O.B.E., A.R.C.Sc., B.Sc., D.I.C., D.Phil., F.R.Ae.S., F.R.S.A.
18th April—Junior Prize Lecture, Branch Members.
2nd May—Annual General Meeting and Smoking Concert.
3rd October—The History of the Aviation Engine, Air Commodore F. R. Banks, C.B., O.B.E., F.R.Ae.S., M.I.Mech.E.
17th October—Aviation Fuels, Lubricants and Special Products, J. R. Bradford.
31st October—Operation "Viking," R. C. Morgan, A.F.R.Ae.S.
7th November—Bombers from the Operators' Point of View, Air Commodore H. Satterly, C.B., C.B.E., D.F.C.
28th November—Principles of Space Flight, A. C. Clarke, B.Sc., F.R.Ae.S.
12th December—Brains Trust: Air Vice-Marshal G. W. Tuttle, C.B., O.B.E., D.F.C., A. A. Hall, M.A., F.R.Ae.S., Charles Gardner, O.B.E., A.R.Ae.S., G. R. Edwards, M.B.E., B.Sc., F.R.Ae.S., A.M.I.Struct.E.
28th December—Annual Dance.

YEOVIL BRANCH

15th November—The Future of Air Power, Air Marshal Sir Robert H. M. Saundby, K.B.E., C.B., M.C., D.F.C., A.F.C., R.A.F. (Retired).
12th December—Local Railway Systems, A. Osborne; and Helicopter Aerobatics (a Film).

ELECTIONS OF NEW MEMBERS AND TRANSFERS OF MEMBERSHIP

JANUARY 1951

Associate Fellows

Ernest Hey
Charles Victor Lane
John McCulloch (from *Graduate*)
William Bailey Mawson
H. A. Raghunatha Rao
Peter Stransom Robinson
John Cyril Knowles Shipp
Eric Smith (from *Graduate*)
Stanley Frank Stapleton (from *Graduate*)
Albert James Lambert White
John Bennett Witchell (from *Graduate*)
Ronald Bruce Wyke (from *Graduate*)

Associates

Alexander Gordon Duguid
Thomas Leslie Husband
Leonard Anthony Jackson
Ved Kumar
Alfred Redley
Douglas Rigg
Harry Victor Snook
William George James Symonds
Trevelyan William Tremayne
Frederick George Williams

Graduates

Brian Buss
Burton George Cour-Palais
Ronald John Frost
Derrick Ernest Gladwin
Kenneth David Harris (from *Student*)
John Trewyn Hawken
Gordon James Hunt
Hugh Somerton Mettam (from *Student*)
Gerald Victor Page
Rai Gangeshwari Prasad
Geoffrey Bryning Tyler
Mark Cunningham Warden

Students

Maurice John Averay
Alen Edward Cresswell
Eric Thomas Hill
John Keith Hunt
Raymond Long
Ian McGregor
Ivan Franz Mayer
Mieczyslaw Jerzy Meller
Vernon Keith Merrick
Richard Douglas Cook Passey
Peter Henry Reed
Calvin Wyatt Rose
George Albert Sellars
Eric Henry Smith

John Brian Spencer
Richard Julian Stowe
Bernard Toner
Gordon Harry Vosper
Martin James Wagrel
Sidney Walmsley
John Robert Ward
John Lawrence Taliesyn Williams
Christopher John William Woodruff

Companion
Alfred Brian Hugo Lamplugh

FEBRUARY 1951

Associate Fellows
Frank Harry Bond (from *Graduate*)
Raymond Montrose Brown (from *Graduate*)
Robert Ellis Chapman (from *Associate*)
Charles Leslie Dann
Ernest James Grewcock (from *Graduate*)
Charles Henry Johns (from *Associate*)
Hiram Oliver West
Thomas George Holmes Woolford (from *Graduate*)

Associates
Rex Norman Spurden Burley
John Henry Hotson
Charles Edward Hutt
Ian David Kitson
Ernest Sidney Moore
Alfred Arthur Old
Mathew Alexander Ernest Quinn

Graduates
Robert Edward Finch (from *Student*)
Gordon Robert Parker (from *Student*)
John Michael Ramsden
Peter Travers Ross (from *Student*)
Hitendra Nath Roy
Soli Kaikhushru Sahiar (from *Student*)
Barnes Winstanley Wallis
Jesus Ernest Vargas (from *Student*)

Students
Henry William Groves
Ian Harwood
John Ernest Walford

MARCH 1951

Associate Fellows
Stanley Thomas Alvey
Kenneth Nairn Beatts (from *Graduate*)
Walter Gordon Bradfield (from *Graduate*)
Ronald Peart Cauthery
Kenneth Sydney Robert Child (from *Graduate*)
William Stevenson Cunningham (from *Graduate*)
John Derek Davis (from *Student*)
John Reginald Gardiner (from *Associate*)
Kenneth William Kimber (from *Graduate*)
Herbert Richard Leather (from *Graduate*)
Cecil James Olaf Moorhouse (from *Graduate*)
Alfred Webb Lindley
Maxwell Edmund Masy Perkins
Douglas Edgar Sidders
Robert Henry Warde

Associates
John Bezzant
Frederick Walter Brightwell
Walter Alfred Bunce
Thomas George Evans
Edward Henry Holder
Brian Peter Hough
David Johnson
Harold Douglas Judkins
Frederick Alfred Laker
John Laver
Bernard John Stephens
Stanley Williams
Ronald James Wybrow

Graduates
Richard Francis Beresford (from *Student*)
David Brown (from *Student*)
Peter John Chance (from *Student*)

John James Cripps
Edmundo Gomes Ferreira Da Silva (from *Student*)
Roy William Edwards
Frank Gowens
Brian John Griffin (from *Student*)
Edwin Mosey Harris (from *Student*)
David Hobson Hughes
Abraham Mendel Geoffrey Olsen (from *Student*)
Ralph Parker
Robert Charles Pennicott (from *Student*)
Denis John Powell (from *Student*)
Gordon Reynard
Ronald Lion Samuels (from *Student*)
David Kenshett Saunders (from *Student*)
David Shellard (from *Student*)
Phillip Reginald Simons
I. Elefterios Vezyrianidis
Robert Charles Wallin (from *Student*)
Charles Ronald John Whitfield
Ivan Ray Yates

Students

Malcolm Hesketh Barratt
Nigel Kenneth Benson
Ian Kendrick Blaen
Harry Bonney
David Philip Bowker
David John Bown
Peter Cambridge
Thomas Leon Dalzell
Victor Cecil Doggrell
Clive Ayrton Fleming
Sydney Oliver Frith
Allan Stuart Gilfile
John Harris
Arthur Thomas Hills
Harold Melville Kent
Surinder Bahadur Mathur
Ian Douglas Neilson
John Eric Nelson
Peter Chukuyenum Fielding Obi
Peter Robert Stokes
Derek Wardle Pickston
Anthony Willis
Garnet Wojna
Ernest Martin Woodhams

APRIL 1951

Associate Fellows

Eric Aubrey (from *Graduate*)
Norman Frederick George Banfield (from *Graduate*)
Brian Stewart Eamer Beattie (from *Graduate*)
John William Davison
Peter Edward Felgate
Stefan Alexander Grott
Keith Leonard Charles Legg (from *Student*)
William Maurice Locke (from *Graduate*)
Ian Robert Lyon (from *Graduate*)
Maitland Robert Roper (from *Associate*)
Theo Vincent Small (from *Graduate*)
Sydney Snell (from *Graduate*)
Harold Geoffrey Spurr
Robert Walter Wilson Tennant (from *Graduate*)
Albert William Watkins

Associates

Richard Frederick John Brock
Basil Benedict Fleming
Lawrence Gray
Gwyn Griffiths
Reginald Hugh Howard
Albert Madoc Lovatt
Frank Henry Roberts
Geoffrey Musgrave Shipway
Sidney Harold Phillip Smith
Ronald John Reynolds Steer
Harold Townley
Ernest Brian Trubshaw
Gordon Arthur Vickers
Harold James Watts

Graduates

Ronald Desmond Anthony (from *Student*)
Alan Edgar Bingham
Victor Rex Bunyard
John Alan Caister (from *Student*)
Trevor Storr Davies (from *Student*)
Paul Kichenside Digby
Ronald Edward Dudley
Robert Harold Ladd
Charles Henry Martin
George Beric Parkin
Harry Nigel Saint (from *Student*)
Arthur Griffith Patrick Vaughan
Geoffrey Wass (from *Student*)

Students

Charles John Adey
Robert Colville Aikman
John Alfred Bones
Alexander Campbell Craighead
John Ernest Felstead
Thomas Henry Hallstaff
Raymond Alan Harrison
John Charles Michael Jones
John Barry Large
Harold Moore Lofthouse
Lawrence Pickering
David Arthur Sharp

Companions

Yashvant Thakorelal Desai (from *Graduate*)
John Valentine Amyard Haggard
Dennis Job Upton
George Frederick Watson

MAY 1951

Associate Fellow

Victor Roy Gordon Smith (from *Graduate*)

Associates

Patrick Coyle
George Boi Ditchman

Graduates

Ronald Arthur Berridge (from *Student*)
Malcolmn Keith Bowden (from *Student*)
Edward Lewis Houghton (from *Student*)
Framji Minochehr Soonawalla
Edward Wray (from *Student*)

Students

Healey Vandelow Allen
Ivan Jeffrey Goldberg
Kriti Kumar Mukerjee

JUNE 1951

Associate Fellows

Peter Henry Curnow (from *Graduate*)
William Marlow Evans
Warren Hayward (from *Graduate*)
Frank Edward Hunt (from *Associate*)
James Arthur Randle Kay (from *Associate*)
Gordon Geoffrey Levy
Peter Maurice William Noel (from *Student*)
Frederick Herbert Parker
Cyril Arundel Pemberthy (from *Associate*)
Herbert John Rix (from *Associate*)
Alan John Salmon (from *Associate*)
Joseph Goulding Sharp
John Hall Sinclair (from *Associate*)
Victor William Steele (from *Associate*)
William Laing Stewart
Geoffrey Arthur Virley Tyson (from *Associate*)
Albert Maurel Uttley
Montague Wotton Wood (ex-*Associate Fellow*)
Ronald Frederick Worlidge

Associates

Ronald Winn Beatty
John Anderson Brennan
Ronald Campbell Cowan
Frederick James Ellen (from *Companion*)
Frederick William Hailstone
Jack Morris Keene-Miller
John Desmond Monice
Laurence Charles Neill Penney
George Patrick Bentley Shaw-Yates
James Watt Wilson

Graduates

Rene M. Bloch
Patrick Cornelius Donovan (from *Student*)
John Richard Green
John Harold Horlock
John Laurence Horne (from *Student*)
Laurie Hosking
Ronald George Knight (from *Student*)
John Arthur Beverley Lambert (from *Student*)
John Mansell Lewendon
Alan John Leonard Mitchell
John Maxwell Roberts

Stuart Raymond Sarrailhé (from *Student*)
Dennis William Taylor (from *Student*)
Roy Thompson-Holland (from *Student*)
Norman Turner
Kenneth Robin Warren (from *Student*)
Robert Henry White (from *Student*)

Students

Leonard Bernstein
Michael John Broad
Peter William Fitt
Frederick James Hill
Thomas Guthrie Hunter
Zbigniew Jawor
Peter Numa Joubert
Shadi Lal
Edward Robert Albert Landers
John Malcolm Parr
Colin Gilbert Plane
Trevor Howard Powell
David Kenneth Dunn Rees
Alan Edmund Smith
Peter John Sole
Alexander Syme
John Edward Talbot
William John Taylor

Companions

George Ivan Holyman
Leslie Dennis Howes

JULY 1951

Associate Fellows

Humphrey Chetwood
Geoffrey St. Quinton Crockett (from *Graduate*)
David Jeffrey Goman (from *Associate*)
John Charles Hamon (from *Graduate*)
George William Jones
John Alexander Kent (from *Associate*)
George Geoffrey Legg (from *Graduate*)
James Robert MacLachlan
Maurice Edward Maxwell (ex-Graduate)
William Farquhar Murray
Leslie William James Newman
Alan Pyke

Associates

Edward Michael Bellamy
Harold William Boothroyde
Robert Joseph Evans
Stephen Frederick Hemsted
Clifford John Le Couteur
James Leggat (from *Student*)
Robert Ward Leslie
Arnold McArthy
Harold Josiah Shipp
Richard Kenneth Slatter
William Charles George Smith
Willoughby Sidney Worner
John Esmond Yates-Earl

Graduates

Peter Phillip Benham (from *Student*)
Bryan Robert Alexander Burns (from *Student*)
Francis Herbert Carr
John Charles Chicken (from *Student*)
John Cyril Fell
Maurice Massey Gates
David Harris (from *Student*)
Robin Edward Keates
John William Paulsen (from *Student*)
Lionel Rossiter Pool (from *Student*)
Ian Frederick Watson (from *Student*)

Students

John Howard Ansley
Bruce Roy Aubin
Harry Grant Boyne
John Robert Burton
David Charles Lavis Francis
Robert Angus Gee
Brian Herbert Guest
Basil Hull
John Leese
Ronald Clive Lovett
Basil Ronald Messenger
Francis Ian Victor Walker
Robert Willoughby

Companions

Guillermo Gonzaler Gomez
Jens Rainer Maria Radok
Charles Frederick Towell

AUGUST 1951

Associate Fellows

Ralph Beasley
Horace Charles Bellamy
Ronald Arthur Berridge (from *Graduate*)

Leonard Ernest Bunnett (from *Associate*)
Ronald Terence Bunting
Keith Busby
Arthur Valentine Cleaver (from *Associate*)
Ivor John Davies
Karl Heinrich Doetsch
Joseph Cyril Guttridge (from *Graduate*)
William Robert Hawks (from *Graduate*)
Dennis Stanley Houghton (from *Graduate*)
Ronald Matthews Howarth
Edward Francis John
Richard Allen Scarth Moss
Stanley Ian Robertson Nicol (from *Graduate*)
Albert George Smith
Robert Dixon Speas
Gordon Thripp
Isaac Torbe
Norman Kenneth Walker
Kenneth Gordon Wallace (from *Associate*)
Charles Frederick Wills (from *Associate*)
Charles Alastair Wood-Collins (from *Associate*)
Dudley Harvey Wright
Syed Yusuff

Associates

John Nicholas Bean
John Clement Bell
Walter Eric Brown
Arthur Vincent Branscombe
Joseph Montague Caudle
Thomas Duncan Chapman
Harold Williams Chiverton
Neville Frederick Duke
Raymond Hart (from *Student*)
John Hunter
Richard Buckingham Keusch
Ralph Kirke
Arthur Craven Ledger
Frederick Henry Edwards Maidment
Bernard Stanley Murphy
Sidney Major Russell

Graduates

Francis Henry Borlace (from Student)
Henry Mervyn Briscoe
William Edward Thomas Cawsey (from *Student*)
James Joseph Foody
Maruti Kishor
Patrick Gerrard McCabe
Robert Victor Read (from *Student*)
Christopher John Rogers (from *Student*)
Gordon Sim (from *Student*)
George Walter Yates

Students

Henry Beresford
William Roderick Burge
Leon Charles
Peter Neville Cornall
Anthony John Heath
Richard Godfrey Palgrave Hood
John Victor Houghton
Andrew Kedar
Frederick Stephen Lynam
John Stuart Mitchell
Edwin Mowforth
Derek Olley
Rolf Person
John Leonard Spatcher
Richard Henry Percival Timms
Ronald Thomas Upton

Companions

George Francis Hugh Hemsley
Bernard Albert Hunn
Stanley Smith
Thomas Walter White

SEPTEMBER 1951

Associate Fellows

Harold Billett
Stanley Kenneth Harley (from *Graduate*)
Gordon Jefferson (from *Graduate*)
Harry Usher Midwood (from *Graduate*)
William Irving Stieglitz
Alexander Ernest Sutherland

Associates

Frederick James Edwards (from *Graduate*)
Denis McManus
Arthur Robert Moore
Caesar B. Pattarini
George Wood

Graduates

Lawrence George Evans
Peter Francis Locker Hall
John Frederick Jones (from *Student*)

OCTOBER 1951

Associate Fellows

Cliford Grainger Andrews
Frank Wallace Austin (from *Graduate*)
Frederick Alfred Cousins (from *Graduate*)
Harry Derrick (from *Graduate*)
Leslie William Dixon (from *Associate*)
John Lancaster Eaton
James Leo O'Reilly
Clarence Herbert Perry (from *Graduate*)
Robert Richard Shaw

Associates

John Leonard Alton
Leonard Charles Down
Kamel Khalil Effat
Robert William Fredericksen
John Edwin Loxton
John Smith MacDougall (from *Student*)
Edward Albert Thomas Mack
Norman Frederick Ruse

Graduates

Arthur Sidwell Bennett (from *Student*)
Joseph Anthony Dietz
Ronald John Yates

Student

John Walter Pooley

NOVEMBER 1951

Associate Fellows

Harry Derrick
Miroslav Nenadovich

Associate

Sydney Highfield Edwards

Graduates

Kenneth John Lelliott
David Edgar Thomas Nichols

DECEMBER 1951

Associate Fellows

Jack Anstess
Frederick Ecton Barnes
Gordon Desmond Bateman (from *Graduate*)
Robert George Bowditch
Jack Bunting
Jean Marie Rene Brogard
David Mark Cockburn
Gavin Fleming Davidson
Frederick John Davison (from *Graduate*)
Stanley Gray (from *Graduate*)
Arthur Francis Houghton (from *Graduate*)
Richard Watson McKay (from *Associate*)
John Nash (from *Associate*)
Herbert Wilfred Rigby
Peter Rivers (from *Graduate*)
Ralph Lovell Edwin Toms (from *Graduate*)
Denis Frederick William Woor (from *Associate*)

Associates

Eddardo A. Borgna
Fred Brookes
Frank Douglas Bush
Edward James Cashman
William Edward Hagan
William Francis Hill
Ivan Beresford Holmes
Frederick Avann Mason (from *Student*)
Leonard Martin Pankhurst
Harry William Smith
Hugh Renus Sutherland
Douglas Cyril Tritton
Charles Victor George Usher
Alfred Williams

Graduates

Aldric B. Au-Yong
Andrew Fyfe Duncan (from *Student*)
George Kenneth Frank Green (from *Student*)
Alan Sidney Henney (ex-*Student*)
Frederick Arthur Hewitt (from *Student*)
Richard Godfrey Palgrave Hood (from *Student*)
Philip Reed Miller (from *Student*)
Robin Salmon
Derrick Francis Simpson
George Edward Whitmarsh

Students

Norman Birch
John Thornton Clarke
Michael John Patmore Cowper
Thomas Patrick Doherty
(from *Graduate*)
Donald John Leech
Eric James Phillips
Gilbert Joseph Rothery
Ivor Harold Smart
Edward Clement Weston

Companions

George Walter Dandridge
John Norman Dean
Albert Geoffrey Griffiths (ex-*Graduate*)
Peter Douglas Dorcenne Bois Rowland

ASSOCIATE FELLOWSHIP EXAMINATION RESULTS

The following were successful in the Associate Fellowship Examination (New Syllabus) held in December 1950:—

PART I

H. A. Buchholdt, Applied Mathematics, Properties of Matter, Heat, Light and Sound, Theory of Machines.

D. W. Cocking, Applied Mathematics, Properties of Matter, Heat, Light and Sound, Theory of Machines.

R. S. Dabbs, Applied Mathematics, Properties of Matter, Heat, Light and Sound, Strength of Aircraft Materials and Theory of Structures I, Theory of Machines.

D. A. Drane, Applied Mathematics, Properties of Matter, Heat, Light and Sound, Strength of Aircraft Materials and Theory of Structures I, Theory of Machines.

G. H. Fenton, Properties of Matter, Heat, Light and Sound.

V. N. Ferriman, Pure Mathematics, Magnetism, Electricity and Electronics, Strength of Aircraft Materials and Theory of Structures I.

D. R. Henbest, Applied Mathematics, Strength of Aircraft Materials and Theory of Structures I, Theory of Machines.

R. L. Holmes, Applied Mathematics, Properties of Matter, Heat, Light and Sound, Aerodynamics I, Theory of Machines.

E. Mowforth, Applied Mathematics, Properties of Matter, Heat, Light and Sound, Strength of Aircraft Materials and Theory of Structures I, Theory of Machines.

C. L. Munro, Applied Mathematics, Strength of Aircraft Materials and Theory of Structures I, Theory of Machines.

W. A. Page, Applied Mathematics, Magnetism, Electricity and Electronics, Theory of Prime Movers and Fuels.

G. S. Pool, Aerodynamics I.

C. R. Raynham, Applied Mathematics, Properties of Matter, Heat, Light and Sound, Strength of Aircraft Materials and Theory of Structures I, Theory of Machines.

B. Shergill, Applied Mathematics, Properties of Matter, Heat, Light and Sound, Strength of Aircraft Materials and Theory of Structures I, Theory of Machines.

I. H. Smart, Applied Mathematics, Properties of Matter, Heat, Light and Sound, Strength of Aircraft Materials and Theory of Structures I, Theory of Machines.

K. Thein, Strength of Aircraft Materials and Theory of Structures I.

F. I. V. Walker, Applied Mathematics, Properties of Matter, Heat, Light and Sound, Strength of Aircraft Materials and Theory of Structures I, Theory of Machines.

ABROAD

A. F. El-Kerdani, Properties of Matter, Heat, Light and Sound.

Krishna Iyer, Applied Mathematics, Strength of Aircraft Materials and Theory of Structures I, Theory of Prime Movers and Fuels.

PART II

B. M. Laven, Aerodynamics II.

The following candidates were successful in the Associate Fellowship Examination held in May 1951:—

PART I

D. S. Bliss
R. Boocock

F. J. Butters
L. J. Geering
C. Mullen
J. M. O'Connell
M. D. Bernard-Smith
P. C. G. Stalkartt
D. Ross Turner
D. Wood

PART II

J. A. H. Bailie
G. H. A. Fenton
J. D. Mann
L. F. Nicholls
R. C. L. Sample
M. J. Taylor
D. W. Wall
E. G. Wilkinson

ACKNOWLEDGMENTS

The Council gratefully acknowledge the following gifts to the Society:—

A "Pilot's Calculator" from Shell-Mex and B.P. Ltd.

A collection of historical slides, from W. H. Brody, Esq., Director of the North Bar Tool Company.

The first and second volumes of the Advisory Committee for Aeronautics Reports, from Group Captain A. J. Miley, O.B.E.

A complete file of "Inter-Avia," from Wing Commander R. H. Stocken, *Associate Fellow*.

Books, periodicals, pamphlets and publications, from Dr. K. G. Bergin, *Associate Fellow*; P. V. Hoare, *Fellow*; D. J. A. Jacobs, and Air Commodore E. A. Masterman, C.B., C.M.G., C.B.E., A.F.C.

Back numbers of the JOURNAL, from John Adams, Esq.; Dr. K. G. Bergin, *Associate Fellow*; the Bristol Aeroplane Co. Ltd.; the British Aluminium Co. Ltd.; R. L. Carter, Esq., *Associate*; Miss L. Chitty, *Fellow*; A. M. Desoutter, Esq., *Associate Fellow*; Wing Commander D. M. Egan, *Associate*; E. C. Gibbons, Esq., *Associate Fellow*; S. P. P. Guy, Esq., ex-*Student*; F. Holouhek, Esq., *Associate Fellow*; Miss M. M. Hopkins; B. Kaiser, Esq., *Associate Fellow*; Major R. H. Mayo, *Fellow*; Group Captain E. G. M. Neville, *Associate Fellow*; S. P. Prauss, Esq., *Associate Fellow*; A. Dennison Scarlett, Esq.; *Associate Fellow*; D. M. Smith, Esq., *Fellow*; T. H. Turner, Esq.; W. Tye, Esq., *Fellow*; P. H. Watson, Esq., *Associate Fellow*; and Air Commodore Sir Frank Whittle, *Fellow*.

THE LIBRARY

In addition to the many reports, technical notes and memoranda, the following books and papers have been added to the Library during the past twelve months:—

ACCIDENTS

1. Crash Injury Research: Handbook for Aircraft Accident Investigators.
2. Guggenheim Aviation Safety Center: Survey of Research Projects in the Field of Aviation Safety. (A bibliography.)

ADHESIVES

1. De Bruyne, N. A. and Houwink, R.: Adhesion and Adhesives.

AERODYNAMICS

1. Dommasch, D. O., et al: Airplane Aerodynamics.
2. Ghaffari, A. G.: Hodograph Method in Gas Dynamics.
3. Kopal, Z.: Tables of Supersonic Flow around Cones of Large Yaw.
4. Kuethe, A. M. and Schetzer, J. G.: Foundations of Aerodynamics.
5. Pope, A.: Basic Wing and Airfoil Theory.
6. Pope, A.: Aerodynamics of Supersonic Flight.
7. Sibert, H. W. High Speed Aerodynamics.
8. U.S. Bureau of Ordnance: Handbook of Supersonic Aerodynamics, Vol. II.

AIRCRAFT, CONSTRUCTION AND COMPONENTS

1. Brown, G. S. and Campbell, D. P.: Principles of Servo-Mechanisms.
2. Froesch, C.: What is needed in future airline transport airplanes.
3. Neville, L. E.: Aircraft Designers' Data Book.

4. Niles, A. S. and Newell, J. S.: Airplane Structures, 3rd Edition.
5. Pollitt, C. A. H.: Air Systems for Aircraft.
6. Porter, A.: Introduction to Servo-Mechanisms.
7. Scanlan, R. H. and Rosenbaum, R.: Aircraft Vibration and Flutter.
8. U.S. Air Force, etc.: Sandwich Construction for Aircraft, Parts I and II.
9. U.S. Air Force, etc.: Design of Wood Aircraft Structures.
10. U.S. Navy: Aircraft Hydraulics.

AIRCRAFT, GENERAL

1. Liptrot, R. N.: Convertible Aircraft.
2. Palmer, D. and Penney, A. C.: Aircraft.
3. Taylor, J. W. R. and Allward, M. F.: Wings for Tomorrow.

AVIATION, GENERAL

1. Anderson, E. W.: Principles of Air Navigation.
2. Bailey, S. F. and Smith, L. M.: Handbook of Agricultural Pest Control.
3. Bakan, D. and Ewart, E. S.: Visual Deficiency and Flying Experience following Flight Training.
4. Bartlett, Sir F. and Mackworth, H. N.: Planned Seeing.
5. Bergin, K. G.: Collected Papers on Aviation Medicine.
6. Civil Aeronautics Administration: Flight Instruction Manual.
7. Haus, F.: Etude théorique du pilotage automatique des avions.
8. Rambo, W. R., Prichard, J. S., et al: Final Report on Evaluation of Omni-Bearing-Distance System of Air Navigation.
9. Tufts College: Handbook of Human Engineering Data for Design Engineers.
10. Varney, A.: Psychology of Flight.
11. Whittingham, Sir Harold: Collected papers on Aviation Medicine.

BIOGRAPHY AND MEMOIRS

1. Dorman, G.: British Test Pilots.
2. Kelly, F. C.: Miracle at Kitty Hawk: the Letters of Wilbur and Orville Wright.

CIVIL AVIATION

1. Civil Aeronautics Administration: Standard Specification for Construction of Airports.
2. Dawson, J. A.: Planning and Construction of Airfields.
3. Fradkin, E. K.: A World Airlift: The United Nations Air Police Patrol.
4. H.M.S.O.: Civil Aviation Act 1949.
5. Massachusetts Institute of Technology: Proceedings: Conference on Ground Facilities for Air Transportation.
6. Ministry of Civil Aviation: Aviation Law for Private Pilots.
7. Roadcap, R. R.: World Airline Record.
8. Shawcross and Beaumont on Air Law.
9. Tendler, M. and Holz, F. M. (editors): Official Airline Route and Mileage Manual.

ELECTRONICS, RADIO, RADAR, ETC.

1. Cadell, C. S. and O'Kane, B. J.: 40 Years' Progress in Air Radio.
2. Marton, L. (editor): Advances in Electronics, Vol. III.

ENGINEERING, GENERAL

1. American Mathematical Society: Symposium, Vol. III: Elasticity.
2. Clark, D. A. R.: Advanced Strength of Materials.
3. Connolly, J. V.: Production Engineering, Administration and Management.
4. Crede, C. E.: Vibration and Shock Isolation.
5. Devons, E.: Planning in Practice.
6. Elbourne, E. T.: Fundamentals of Industrial Administration, 4th edition.
7. Frost, M. G.: Teach Yourself Management.
8. Hadekel, R.: Displacement Pumps and Motors.
9. Lipson, C., et al: Stress and Strength of Manufactured Parts.

10. Macmillan, R. H.: Theory of Control in Mechanical Engineering.
11. Murray, G. L.: American (3rd angle) and British (1st angle) Projection.
12. Singer, F. L.: Strength of Materials.

FUELS AND LUBRICANTS

1. Lang, H. R. (editor): Physics of Lubrication.
2. Latimer-Needham, C. H.: Refuelling in Flight.
3. Smith, H. M., et al: Aviation Gasolene and its Component Hydrocarbons.

HIGH ALTITUDE AND INTERPLANETARY FLIGHT

1. Clarke, A. C.: Exploration of Space.
2. Marbarger, J. P.: Space Medicine.
3. Vaeth, J. G.: 200 Miles Up.

HISTORICAL AND MILITARY AVIATION

1. Brickhill, P. The Dam Busters.
2. Clostermann, P. The Big Show.
3. De Seversky, A. P.: Air Power: Key to Survival.
4. Dorman, G.: Fifty Years Fly Past.
5. Hurren, B. J.: Fellowship of the Air.
6. Lawrence, W. J.: Number 5 Bomber Group, R.A.F. (1939-45).
7. Ward Lock & Co.: The Wonder Book of the R.A.F.
8. Whitty, H. R.: Observers' Tale. The Story of Group 107 of the R.O.C.

HYDRODYNAMICS

1. Binder, R. C.: Advanced Fluid Dynamics and Fluid Flow.
2. de Feriet, J. K.: The Statistical Theory of Turbulence; Harmonic Analysis.
3. Frenkiel, F. N.: Introduction to some Topics on Turbulence.
4. Goldstein, S.: Linearised Theory of Supersonic Flow.
5. Institute of Physics: Some Aspects of Fluid Flow.
6. Sauer, R.: Ecoulements des fluides compressibles.
7. Schlichting, H.: Grenzschicht-Theorie.
8. Streeter, V. L.: Fluid Mechanics.

MATERIALS

1. A.S.T.M.: Symposium on Plasticity and Creep of Metals.
2. A.S.T.M.: Symposium on Ultrasonic Testing.
3. B.S.I.: Aluminium and Aluminium Alloy Sections: B.S.1161.
4. B.S.I.: Wrought Aluminium and Aluminium Alloys: Bars, Rods, Sections: B.S.1476.
5. Chalmers, B.: The Structure and Mechanical Properties of Metals.
6. Engel, H. C., et al: Structural Plastics.
7. Ladoo, R. B. and Myers, W. M.: Non-metallic Minerals, 2nd Edition.
8. Mond Nickel: Nickel Cast Iron.
9. Mond Nickel: Isothermal Transformation Diagrams for Nickel Steels.
10. Rotherham, L.: Creep of Metals.
11. United Steel Companies: Standard Methods of Analysis of Iron, Steel and Ferro-Alloys.

MATHEMATICS

1. Goldstein, H.: Classical Mechanics.
2. Hymans, J. C. S.: Guns, Shells and Rockets: a Simple Guide to Ballistics.
3. Inglis, Sir C.: Applied Mechanics for Engineers.
4. Langhaar, H. L.: Dimensional Analysis and Theory of Models.
5. Low, A. R.: Normal Elliptic Functions.
6. Morse, P. M. and Kimball, G. E.: Methods of Operations Research.
7. Oldenburger, R.: Mathematical Engineering Analysis.
8. Proell, W. and Bowman, N. J.: Handbook of Space Flight.
9. Timoshenko, S. and Young, D. H.: Engineering Mechanics, 3rd Edition.
10. Wade, T. L.: The Algebra of Vectors and Matrices.
11. Walther, A.: American Fiat Review of German Science, 1939-46.

METEOROLOGY
1. Perrie, E. W.: Cloud Physics.
2. Schonland, B. F. J.: The Flight of Thunderbolts.

PARACHUTES
1. Brown, W. D.: Parachutes.

PHYSICS AND CHEMISTRY
1. Glasstone, S.: Sourcebook on Atomic Energy.

PROPULSION
1. Banks, F. R.: The Aviation Engine.
2. Bolster, C. M.: The Assisted Take-off of Aircraft.
3. Bowden, C. E.: Diesel Model Engines, 3rd Edition.
4. Casamassa, J. V.: Jet Aircraft Power Systems.
5. Cohen, H. and Rogers, G. F. C.: Gas Turbine Theory.
6. Durham, F. P.: Aircraft Jet Power Plants.
7. Fisher, C. H.: Carburation.
8. Lichty, L. C.: Internal Combustion Engines, 6th Edition.
9. Morley, A. W.: Performance of a Piston-Type Aero Engine.
10. Owner, F. M.: The Application of Power to Aircraft.
11. Rogerson, E. C.: The Industrial Gas Turbine.
12. Welsh, R. J. and Waller, G.: The Gas Turbine Manual.
13. Wilkinson, P. H.: Aircraft Engines of the World.

THERMODYNAMICS
1. Hall, N. A.: Thermodynamics of Fluid Flow.
2. Lewis, B. and von Elbe, G.: Combustion, Flames and Explosions of Gases.
3. Samaras, D. G.: Fluid Dynamics of Energy Release.
4. Samaras, D. G.: Heat Propagation, Past and Future.

MISCELLANEOUS
1. Aeronautical Research Committee: Technical Reports 1940-41.
2. American Aviation: American Aviation Directory.
3. British Standards Institution: Year Book 1951.
4. Camm, F. J. (editor): Newnes' Engineer's Reference Book 1951.
5. Curry, B., et al: Bibliography: Supersonics or Ultrasonics.
6. Langdon-Davies, J.: Jubilee Book of the National Physical Laboratory.
7. Institution of Naval Architects: Transactions, Vol. 92.
8. Institution of Production Engineers: Proceedings, Vol. XXIX.
9. Society for Experimental Stress Analysis: Proceedings, Vol. IX, Part I.
10. Temple Press: Aeroplane Directory 1951.

OBITUARIES 1951

The death in 1951 of the following members of the Society is recorded with regret:—

Flight Lieutenant R. H. Anderson (*Associate Fellow*)
G. N. Beckmann (*Associate*)
Squadron Leader H. R. Bunn (*Associate*)
C. Cave (*Companion*)
C. Ainsworth Davis (*Associate Fellow*)
Wing Commander L. A. W. Deane (*Associate*)
H. Dewey (*Associate*)
A. E. F. Donovan (*Student*)
W. E. Dumbrill (*Fellow*)
J. E. Ellor (*Fellow*)
O. G. Falwasser (*Associate*)
Lieut. Commander (E) D. K. Hanson, R.N. (*Associate*)
C. A. Hedger (*Associate Fellow*)
S. T. Melling (*Associate Fellow*)
W. G. A. Perring (*Fellow*)
A. R. Scott (*Associate Fellow*)
B. I. Singh (*Student*)
S. J. Stocks (*Associate Fellow*)
Air Commodore Cresswell Turner (*Associate Fellow*)
L. D. Tye (*Student*)
A. P. C. Webster (*Associate Fellow*)
Lieutenant E. M. Welch, R.N. (*Associate*)

REVIEWS

The following books are reviewed:—

The Dam Busters	Methods of Operations Research
The Exploration of Space	Aircraft Engines of the World
Fellowship of the Air: Jubilee Book of the Royal Aero Club	Rockets and Jets (*For Children*)
200 Miles Up	Always Tomorrow
	Air Bridge (Fiction)

THE DAM BUSTERS. Paul Brickhill Evans Brothers Ltd. London. 1951. 269 pp. 18 illustrations. 15s. net.

In *The Great Escape*, Paul Brickhill told a terrible and dramatic story made vivid by personal experience as a prisoner of war. With the same sympathetic insight, based this time on his knowledge of flying as a war-time pilot, he now brings to life the dynamic atmosphere of one of the most remarkable Squadrons the Royal Air Force ever produced, No. 617; re-telling, with such consummate skill that it all seems new,the great epics of Moehne and Eder Dams, Peenemunde, sinking the "Tirpitz," blocking the Saunur Tunnel, and devastating raids on bridge and viaduct, submarine pen, and secret weapon.

This is a fine book—almost a great one—and may well prove to be a best-seller, for its pages have caught the very spirit of the gods and heroes: the courage, the high spirits, the tragedy of youth who went to war and, against the outcry of nerve and flesh, endured; fulfilling their bitter duty against such odds that their own death became a threefold statistical certainty.

Brickhill's fast-moving story aims at portraying the Squadron as an entity, but such are the deftly reported snatches of conversation and the characterisation of pilots and crews, that they are illumined with reality. A picked band of volunteers, in this most unusual and perilous of squadrons, they were trained to use special sights and weapons unavailable to the main striking force of Bomber Command. Against the squadron background successive leaders of 617 are projected with sharper focus, emphasising their distinctive qualities: Air Marshal Cochrane, master-mind of the Group; Guy Gibson, the eager, forceful personality who set so high a standard from the beginning; Cheshire, the dreaming realist who devised the pin-point bomber marking technique; Martin, the virtuoso of tree-top flying; Tait who told the crews to bomb at him as marker; Farquier who insisted on his own demotion from Air Commodore in order to be given command.

Behind them all is the shadowy figure of B. N. Wallis, the brilliant Vickers designer, who saw that his mission was to devise bombing techniques so astoundingly effective that they would shorten the war by their devastation of German economy. The history of 617, from its inception in 1943, is integrated with the development of his series of unconventional shock-wave bombs: first the creeping dam-buster, and then the deep penetration "tall-boy" and the "grand slam."

It is with the struggles of Wallis to get his unconventional theory of bombing accepted by Ministry of Supply technicians and High Command, that the story begins, and appropriately with his quotation of King David's cry it ends: "Is not this the blood of the men that went in jeopardy all their lives?"

THE EXPLORATION OF SPACE. Arthur C. Clarke, B.Sc., F.R.Ae.S. Temple Press. London. 1951. 198 pp. 15 plates (4 in colour). 18 figures. 12s. 6d. net.

There is a striking parallel between the position of astronautics today and that of aeronautics perhaps fifty years ago, but with the notable difference that the world at large adopts a more sympathetic and interested attitude towards the pioneers of space flight than it did to the early flying men. Applied science has taken such strides during the past generation that people are now more willing to accept predictions of further wonderful things to come; moreover, with many past examples

to point the moral, they also realise that these things are the concern of us all, because, in one way or another, they will affect us all.

The Exploration of Space is a book intended to give the intelligent layman some idea of just what lies behind this subject of inter-planetary flight, about which there is currently so much talk in the newspapers and elsewhere. It is not the first of its kind; of its many predecessors, some have been good, some bad, most indifferent, but (in at least this reviewer's opinion) Mr. Clarke has produced the best work of this sort up to the present. He is Chairman of the British Interplanetary Society, and freely acknowledges his debt to colleagues of that pioneer group for many of the ideas described. It is doubtful, however, in view of the well-known inability of most technical people to express their ideas in simple language, if many of them could have equalled the author's lucid and entertaining style.

The long history of astronautics, the basic principles of rocket propulsion and the dynamics of space flight, and the probable appearance of future "space ships" and "space stations," are all described; so also are the features of the moon and planets, and the other suns of our universe. The problems likely to be met when bases need to be established on other worlds are discussed, and one chapter even deals with the possibility of *inter-stellar* flight! In a concluding chapter (aptly preceded by a quotation from Walt Whitman: "Ah, who shall soothe these feverish children? Who justify these restless explorations?"), Mr. Clarke argues the case for pursuing the researches on which his book is based. He concludes, reasonably enough, that the curiosity which leads to them is part of the essential nature of man, and that there is the same justification for attempting inter-planetary travel as there was for any of our earlier excursions into new places, or new fields of knowledge. Furthermore, when men see terrestrial affairs in their true perspective against the cosmos, he believes (with an engaging optimism) that they will become more truly civilised.

Because the book is addressed primarily to laymen, it should not be inferred that aeronautical specialists are likely to find it lacking in interest; on the contrary, they should find both relaxation and stimulus from such a consideration of the problems of their successors, as a change from the pressing problems of contemporary design offices, laboratories, or workshops! Although not highly technical, and devoid of mathematics, the work is technically accurate, and largely devoted to the description of advanced technical ideas. The publishers are to be congratulated on having produced it for such a low cost.

FELLOWSHIP OF THE AIR: JUBILEE BOOK OF THE ROYAL AERO CLUB, 1901-1951. B. J. Hurren. Published for *Flight* by Iliffe and Sons Ltd. London. 1951. 234 pp. 88 illustrations. 30s. net.

"As one who has been closely associated with the development of practical flying from its very beginning," writes Lord Brabazon, President of the Royal Aero Club, in an introduction, "I can truly say that Mr. Bernard Hurren has adequately covered the whole period of the fifty years which have culminated in the jubilee of the Club."

It depends upon what you mean by adequately. The Oxford dictionary defines adequate as sufficient. Is this history of the Royal Aero Club sufficient then? In a particular sense it is. In a general sense it is not. The author has done an adequate job as far as much of the factual history of the Club is concerned. The history is all there to read, for the author has clearly been given all the facilities he required by the Aero Club, and he has made excellent use of those facilities. He has read his Minutes but he has not shown the sway of personalities which led to the dull compromise of the accepted resolution.

Perhaps the reviewer is being a little hard on the writer, who may retort that the law prevents the truth being told until all concerned and their relatives and their descendants unto the third and fourth generation are well and truly dead. Perhaps that is why history is never completely satisfying, never quite adequate, until the people who could have written have passed into history themselves.

Flesh and blood and bones make up the living animal. Here is some of the flesh and most of the bones that make the Club the greatest Aero Club in the world, but where, oh where, is the blood? Eighty-eight illustrations and the only one of Harold Perrin, for 40 years the secretary of the Club, shows him in a newspaper photograph between two cup winners of 1931. Harold, like and disliked, Harold the hearty, Harold the aggressive, assertive, what you will, but a man with blood in his veins, a man who called high and low by their Christian names before the Americans had thought of it, a man who will be remembered by those who knew him when many others are forgotten who had greater opportunities than the man whose early history is not even touched upon.

The author has had an unenviable task, an impossible one in many ways. But some day someone must really get Sir Francis McClean, Oswald Short, Lord Brabazon . . . . oh, well, the names are all in the book . . . . to take down what hair they have left and make them talk off the record, and provide the flesh of the Fellowship of the Air with the warm blood of a flying animal.

The Royal Aero Club has done great things for practical flying, and it is indeed time that it received full credit for what it has done and the work, arduous work, of so many of its devoted members.

In these pages appear the names of the Presidents, Vice Presidents, Chairmen, and Chairmen of the Racing Committee of the Club. To them the Club has owed its very existence over the years; to them has been given the great task of guiding it towards the fulfilment of its objects; in their hands (and in those of the staff which serves it so well) has been kept safe the prestige of the Club which is *their* Club.

For many, as for the reviewer, this is a nostalgic book. Much of what the reviewer has read he has lived through again. Perhaps that is why he asks for blood, for so much of those early years of flying achievement were made vitally alive by those whose names are thick on these pages

> "Sound, sound the clarion, fill the fife,
> Throughout the sensual world proclaim,
> One crowded hour of glorious life
> Is worth an age without a name."

The crowded hours of glorious life in the history of the Royal Aero Club were not found in the scattered minutes of its committees by the author.

200 MILES UP. J. Gordon Vaeth. Ronald Press. New York. 1951. 207 pp. 62 illustrations. 32s. net.

Mr, Vaeth has had an interesting career; after serving as an officer in the airship service of the U.S. Navy, on wartime air crew duties, he graduated into free ballooning and the use of these most ancient of aerial vehicles for upper-atmospheric investigations. At one time, as he describes in his book, he was a member of "Project Helios," an official attempt to send a manned balloon to an altitude of 100,000 feet which was finally abandoned because of the uncertain effect of cosmic radiation on the crew. From these activities, he passed naturally (even if surprisingly, on the face of it!) to the use of very different devices for this same purpose of high-altitude research—namely, the large rockets which the U.S. authorities now fire in such numbers, from New Mexico and elsewhere. He is currently employed as a civilian on this work, by the Special Devices Centre of the U.S. Office of Naval Research.

It is a little difficult to decide just what readers *200 Miles Up* is intended to satisfy. What it achieves in fact is to provide, in well-printed and illustrated form, a good permanent record of a most interesting and important field of research, the data on which has hitherto been available only from numerous magazine articles and official reports. In view of the large scope of the work, the author has been unable to go into great technical detail on any aspect of the subject, and he is at all times more concerned with telling, in very readable fashion, the overall story of the subject, than he is with presenting the results obtained from the research, or

the advanced design problems of the devices used to obtain those results. Some specialist workers might therefore be disappointed, especially in view of the price and size of the book, if they hoped to obtain such information from it. To anyone wanting merely to obtain a general picture of the present position on upper-atmospheric studies, it can be strongly recommended.

The available knowledge on atmospheric pressure, density and temperature variation, up to extreme heights, is discussed; so also are such things as cosmic rays and meteors. The sounding balloons, which are still such vital research tools, are described, together with the large rockets (Aerobee, V.2, Viking, and so on) used to extend measurements up to much greater heights. There is a brief description of the principles of rocket flight, with a somewhat guarded admission of the eventual possibility of interplanetary travel; some details of the two-step (V.2+WAC Corporal) rocket, which attained 250 miles in height on 24th February 1949, are given. The firing procedure for such big liquid-propellant rockets is dealt with, and considerable attention is devoted to the instrumentation and telemetering provisions which are made on them. All the illustrations in the book are particularly interesting.

So also, although it may seem surprising in view of the other material covered, is the section devoted to the "Project Skyhood" unmanned high-altitude balloons of the U.S. Navy, used for cosmic ray research. With a gas capacity of 226,500 cubic feet, these balloons spend between 8 and 24 hours at heights of around 100,000 feet; helium is used for inflation of the polyethylene envelope. A different type of neoprene balloon, developed by the U.S. Army, has even reached the record height of 140,000 feet. Mr. Vaeth states emphatically that sightings of these unmanned research balloons are responsible for many, if not most, reports of "flying saucers." On the other hand, he gives, with evident exasperation and no attempt at an explanation, a detailed account of the observation of a mysterious unidentified object on 24th April 1949, by a "Skyhood" launching team which included himself!

METHODS OF OPERATIONS RESEARCH. P. M. Morse and G. E. Kimball. The Technology Press and John Wiley & Sons Inc. New York. Chapman & Hall. London. 1951. 158 pp. Illustrated. Index. $4.00 net. 32s. net.

To a greater degree than ever before, the Second World War was a contest of technical and scientific skill. The pressing need for optimum use of highly technical equipment gave rise to activity known as operational (or operations) research by scientists attached to military commands. Their investigations spread into apparently less technical fields, for scientific study of a vast variety of tactical and strategic problems was found to lead to vastly improved military effectiveness. Since the war, the use of similar methods to improve industrial and commercial operations has been advocated in this country by many scientists concerned with the wartime achievements; Blackett, Watson-Watt, Bernal, Goodeve and others have written compellingly on the subject. Philip Morse (now Professor of Physics at M.I.T.) and George Kimball (now Professor of Chemistry at Columbia University), both concerned with the direction of operations research for the U.S. Navy during the war, have written a book which summarises their experience of the pre-requisites of successful organisation of such activity and gives a large number of detailed examples from wartime operations illustrating the methods. The authors base their exposition on the hypothesis that operations research should now be recognised as an applied science, capable of being taught, and ripe for inclusion in university curricula (as has apparently happened at some American universities).

The introductory chapter, and those dealing with organisation, procedure and the attributes of the successful worker will be of value to anyone contemplating this type of work or concerned in its application. The organisational solutions described were evolved to suit a military application, but many points in common with the industrial case will be found. For example, the same vital distinction exists between operations research and research aimed at the technical aspects of equipment or product development; the research worker or group in either military or civil

applications should be attached to the executive officer responsible for decisions, but should not himself make the decisions—he should carry no executive responsibility. The authors offer a definition of operations research as "a scientific method of providing executive departments with a quantitative basis for decisions regarding operations under their control"; this applies to military or civil operations and leads, as the authors show, to the basic organisational pattern for research groups.

Similar views have been expressed at various times by writers in this country, but a convenient and comprehensive statement has not previously been generally available.

Chapters dealing with various wartime problems and their solution are preceded by some elements of statistical and probability theory. The reader will need more than this background to follow the examples in detail, but the usefulness and power of statistical methods in the solution of such problems will be evident. As the authors remark, although operations research may apply to any branch of science, the mathematical tool provided by statistical and probability theory is probably the most widely useful. Many cases arise where quite simple use of facts and figures can lead to the solution desired, but even in such cases a naive handling of data can lead to seriously wrong deductions. Classic (and surprising) examples concern wrong initial conclusions on optimum convoy size and on the usefulness of anti-aircraft guns on merchant ships.

From the point of view of the aeronautical engineer, it is a pity that the analysis of aircraft servicing and operation was not selected as an illustration. This may not have received the attention in the United States that the R.A.F. gave to it, but it would (unlike the bulk of the material used) have had the merit of bearing directly on peace-time problems. The pre-occupation with military matters is understandable, but it narrows the usefulness of the work and makes it difficult for the reader unfamiliar with current industrial research practices to visualise the application of the techniques to this sphere.

The authors mention the difficulty of interesting first-rate men in peace-time operational research work. It is likely that this difficulty will be exceeded only by that with which managements learn to use the method for their own benefit. For this is itself a subtle art.

AIRCRAFT ENGINES OF THE WORLD. Paul H. Wilkinson. New York. Pitmans. London. 1951. 324 pp. Illustrated. 50s.

The 1951 volume is noteworthy for the number of new gas turbine engines coming into review. Most of the material which is not entirely new seems to have been revised in keeping with up-to-date developments. Altogether there are comprehensive particulars of 57 gas turbine engines and 77 piston engines.

For technical reference the work is divided into two main parts dealing with gas turbine engines (128 pages) and reciprocating engines (162 pages). Each main section is then sub-divided according to the country of manufacture. The data is clearly set out in standardised form, usually with a photograph of the engine.

The usefulness of a book of this kind is perhaps most convincingly demonstrated by its regular reappearance over the past 10 years. Its appeal, from an engine technician's point of view, is rather limited in so far that any such book can only contain the more superficial engineering matter or technical data released for publication elsewhere. It is obviously impossible for the author to print pertinent details of military or commercial importance concerning the latest and most interesting engines. Nevertheless, to many engaged in the various expanding branches of aeronautics it will be most helpful to have at hand an up-to-date authentic collection of available published information dedicated entirely to the aircraft engines of the world.

There is much in the book which will appeal to the general interest. The diversity of engine types is quite remarkable for such a specialised piece of mechanism. This is increasingly apparent in the gas turbine field. Here the small

Turboméca engines make a most interesting contribution, and, at the other end of the scale, the future high-speed propeller turbine is assuming importance. Among the piston engine innovations are the helicopter units and the large American turbo-compounded radials. Collected data on Russian engines comprise five turbo-jets, one rocket motor and eight piston-type engines.

The author has composed a useful introduction summarising the announcements on new developments throughout the world. He also covers outstanding accessory development. For the turbo-jet there is a section on the after burner.

ROCKETS AND JETS (a Parrish Colour Book for Children). Max Parrish. London. 1951. 36 pp. 7s. 6d.

This is a short, instructional picture-book, which is technically accurate. The diagrams are clear and highly coloured and the explanations simple. It is suitable as a Christmas present for a boy of about ten and would probably keep him quiet for about an hour, which is in any case a valuable achievement.

Whether the book will prevent the asking of awkward technical questions by the next generation or will lead to many more, more awkward questions is itself an awkward question which only the recipient can answer.

ALWAYS TOMORROW. John Leeming. George G. Harrop & Co. Ltd. London. 1951. 188 pp. Illustrated. 12s. 6d. net.

In November 1940 an R.A.F. aeroplane crashed near Catania, Sicily. On board were Air Marshal O. T. Boyd on his way to Cairo as Air Officer Commanding Middle East, and John Leeming, a member of his staff, who before the war was a well-known private pilot and the author of several amusing books. Air Marshal Boyd and Mr. Leeming were taken prisoner by the Italians and six months later they were joined by a bevy of generals and other senior British officers, including Major General Neame, V.C., Lieut.-General O'Connor, Major General Carton de Wiart, V.C., and Major General Gambier-Perry.

Always Tomorrow is an account of the life as prisoners of war in Italy of this group of high ranking officers, beginning with the aircraft crash in Sicily which wrecked the career of Air Marshal Boyd.

This book is rightly said to be one of the most amusing written about the War; the author has a keen sense of humour and writes delightfully. The hopes and disappointments of the several attempts at escape are told in a most entertaining way and the lack of emphasis on the less amusing aspects of life as a prisoner of war only serves to underline the unfailing courage, enterprise and patience of these senior officers.

Mr. Leeming writes in a light hearted way and gives an engaging picture of many Italians. Altogether a delightful book.

AIR BRIDGE. Hammond Innes. Collins. London. 1951. 288 pp. 9s. 6d. net.

The author has a reputation for thoroughness and obviously knows something of flying and people who fly; it is said that he visited Berlin and flew on some of the routes during the Berlin Air Lift. Certainly what there is of the Berlin Air Lift in the story is well done and seems to have the right atmosphere, but it is doubtful if those familiar with aero-engines will approve the way in which the engines, which form the central theme of the story, are built. Although, unlike many fictitious stories built round aviation, there is little to enrage those whose life-work is aeronautics, *Air Bridge* is not one of the author's best books.

CORRESPONDENCE

ANGLO-AMERICAN CO-OPERATION

The two months or so that have elapsed since my return to the United States from England have permitted me to cogitate on the nature of such affairs as the joint technical meetings of the Royal Aeronautical Society and the Institute of the Aeronautical Sciences and to consider the lasting values that are derived from them. I have felt some inner compulsion to express these views. My trip to England this past summer, the first since 1947, was memorable for many reasons: the technical meetings, the S.B.A.C. Display, the visits to aircraft factories and to the College of Aeronautics at Cranfield, and the motor trip of three weeks with my family through your beautiful country during this festival year.

As to the Brighton meetings, from whatever angle I review them, they were "all to the good." Technically, much information of benefit was exchanged; socially, many friendships were renewed or made, and from the standpoint of even larger values, one had the rare privilege of hearing the inspiring address of Lord Brabazon at the concluding banquet.

Surely the state of the world today requires us to look well to the protection of our freedoms and to the continuation of the democratic way of life that prevails in our two countries; and, I might add, to the extension of the privilege of aiding others less fortunate than we to acquire these things that can best be described as conditions that assure the realisation of that basic concept—the dignity of man. This requires strength as well as vision, technical ascendancy as well as determination, economic stability as well as economic co-operation.

Air power particularly requires technical superiority accompanied by adequate forces in being: quality and quantity. It is a long and arduous journey from fundamental research in aerodynamics (or other field of aeronautics) to modern war-ready air forces. Some stages on this road are basic experimentation, inductive reasoning therefrom, formulation of fundamental scientific law, all requiring both extensive research apparatus with which to perform experiments and capable men to operate the equipment and assess results. Following fundamental investigations must come applied research directed to specific problems, and then an intensive development effort resulting in prototype aircraft which thereafter must be flown, evaluated, service tested and suitably modified. And finally these designs must be placed in quantity production where problems of organisation, machine tools and tooling, factory layout, materials and labour must be solved effectively.

The peoples of each of our two countries possess national characteristics that tend to make one of them more competent or effective than the other in different items of the stages listed above. In short, neither of us is pre-eminent in every one of these requirements, although together we do seem to excel in all of them. As a team we cannot be beaten and must surely win.

This then is the real outcome of the consideration given to my several experiences in England, from technical meetings, from social events, from personal contacts: our talents are complementary implying a compelling need for us to supplement each other's efforts, to be achieved only by practising the greatest possible degree of co-operation.

I have quoted before from de Tocqueville, but can conclude this letter in no better way than by doing so again. About a century ago he wrote what still holds true:

> "When men feel a natural compassion for each other's ills, when easy and frequent relations bring them every day closer and no susceptibility divides them, it is easy to understand that at need they will mutually assist one another.
>
> "The moral force inherent in a sympathetic understanding between the two great English-speaking peoples is of inestimable worth."

T. P. Wright, F.R.Ae.S., F.I.A.S.

Vice President, Research, and Acting Head, Cornell University.

AIR TRAVEL

With reference to the discussion on "Air Travel from the Passenger's Point of View" (September 1951 JOURNAL) I regret that I could not attend this meeting, but have discussed the proceedings with several friends, of whom one in particular uses air travel fairly widely.

The views expressed on the priorities to be observed in planning for a passenger's comfort and safety are, in our opinion, as follows:

1. Safety.
2. Mental Comfort. The creation of confidence, steps to ensure reassurance if anything untoward occurs. Never leave the passengers "guessing."
3. Tranquillity. Smooth handling on the ground. Simple and clear information.
4. Physical Comfort. Choice of seat when possible. Much deeper head rest and arms adjustable if flight is of more than two hours.
5. Occupation. Easy map reading and more frequent "where we are" from pilot or steward. (I have noted in the U.S.A. that there was a much more friendly and close relationship between the pilot and steward and the passengers over there than one notices here. The pilot was always having a chat with the passengers over the loud speaker, telling them where they were and even making it more personal by, in one case, telling them they would have noted from the sound of the engines that they were running a little more slowly—this was because there was a tail wind and it was up to him to save his boss money by saving petrol, while at the same time, he would guarantee to get the passengers there on time.)
6. Food. Hot drinks and simple food.
7. Other points:
   (*a*) Always ask passengers if it is their first flight and, if so, watch them and see if they need a little reassuring.
   (*b*) If a breakdown causes delay, air crews should always mix with passengers and stop rumours.
   (*c*) Great improvement needed in arrangements for informing those meeting passengers.
   (*d*) Always say "why."

I should like to stress the psychological importance of points 7(*b*), (*c*) and (*d*).

There have been rumours in the past on the airworthiness of certain of our passenger aeroplanes. These might well have been "scotched" at the outset if air crews had been instructed to mix with passengers to prevent foolish rumours liable to be dramatised later.

A number of my friends over the past few years have suffered considerable mental distress due to the absence of information on long-overdue aeroplanes carrying people for whom they cared deeply.

If rational reasons are always given for everything, most fears and rumours are automatically nipped in the bud.

L. J. Cardew Wood, A.C.G.I., B.Sc., A.M.Inst.C.E., A.F.R.Ae.S.

As a "fare-paying" passenger, whose air travelling has to be personally financed, I would like to emphasise the importance of the "all-inclusive" aspect of air travel. In budgeting travelling expenses it is satisfying to know that from departure to arrival, the purchase of the ticket is the only expense directly connected with the journey. I find it a pleasure, moreover, to be freed from the necessity of observing the practice of "tipping" in return for small services.

Lady Douglas fears that, when larger air liners are in use, personal contact between the captain and passengers will have to be discontinued. Having had the pleasure of visiting, at the captain's invitation, the control cabin of a trans-Atlantic

air liner during a crossing, I view with enthusiasm (although in imagination) the prospect of being invited to join the captain's table at dinner on a similar occasion at some future date, after the familiar tradition established at sea. Although the contact may of necessity be restricted, it is to be hoped that it will always, in some measure, be retained.

On the question of preference for a steward or a stewardess (one feels impelled to phrase a sentence which avoids using the plural of the latter) may I claim that, from the passenger's point of view, the preponderance of male passengers is sufficient reason for having a stewardess every time.

Mr. Campbell Orde hints at the possible existence of a minimum acceptable aircraft noise level at which passenger sounds may become irritating. This problem may be accentuated with the advent of rocket-propelled vehicles in which the greater part of the flight will be unpowered and in a rarefied atmosphere. The provision of separate passenger compartments would seem to be desirable on these grounds.

Having spent a night at Prestwick Aerodrome during a flight delay I can confirm Mr. Grey's statement that the facilities there for rest, refreshment and recreation are uncommonly fine.

S. W. Greenwood, *Graduate*
MacDonald College, Quebec, Canada.

Two articles in the September issue of the JOURNAL I have read with interest and pleasure. Firstly, "Some Aspects of Modern Naval Aircraft Design"; this was particularly applicable to my work as I am employed in the Project Office of Chance-Vought Aircraft.

The second article was the Discussion on "Air Travel." It has been my pleasure to travel by air extensively. In 1946, accompanied by my wife and eighteen months old daughter I flew by K.L.M. from Prestwick to La Guardia, New York. The attention and service at Prestwick was excellent; I may be biased in this respect because I am a native of Ayr. The DC-4 was initially comfortable, but during the leg from Reykjavik, Iceland, to New York, flying time 13½ hours non-stop, the whole affair became most uncomfortable; the seat was hard, we were cramped, the rest rooms were completely inadequate for forty passengers. The service and meals were excellent and above reproach, the steward and stewardess were most kind and helpful; for all that, how happy I was when we landed at New York! Since then I have flown internally in the United States in DC-6s, Convairs, and the ubiquitous DC-3; after three hours I find them all uncomfortable. The DC-6 is a definite improvement in room and seat comfort, but in no case have I found the rest rooms to be of a sufficient size to deal with the total aeroplane passenger load over any appreciable time. My suggestions for airline travel are as follows:—

(*i*) Improve the design and size of the rest rooms.
(*ii*) Provide a commentary on the route, *e.g.* "We are at 13,000 feet, I.A.S. 275 m.p.h., passing over the Appalachians," and so on.
(*iii*) Break the monotony by supplying cups of tea or coffee.
(*iv*) Have the captain of the aeroplane meet the passengers during flight.
(*v*) Provide a cocktail bar or lounge, *e.g.* Stratocruiser or D.C-6.
(*vi*) Increase the size of the windows.
(*vii*) Break the overall length of the passenger cabin by means of partitions.
(*viii*) Further improve the seats by providing more room and adjustment.

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THE JOURNAL

OF THE

ROYAL AERONAUTICAL SOCIETY

WITH WHICH IS INCORPORATED THE INSTITUTION OF AERONAUTICAL ENGINEERS

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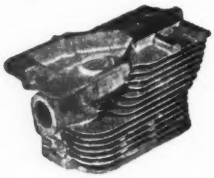

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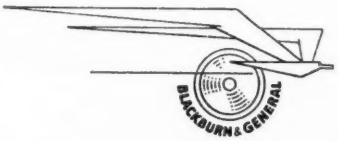

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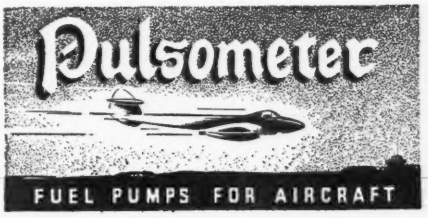

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Short Brothers and Harland Ltd.	Seaplane Works, Queen's Island, Belfast	Belfast 58444
Skyhi Ltd.	"Skyhi" Works, Worton Road, Isleworth, Middlesex	Hounslow 2211
Smiths Aircraft Instruments Ltd.	Cricklewood Works, London, N.W.3	Gladstone 3333
Sperry Gyroscope Co. Ltd., The	Great West Road, Brentford, Middlesex	Ealing 6771
Sterling Metals Ltd.	Northey, Foleshill, Coventry	Coventry 89031
Temple Press Ltd.	Bowling Green Lane, London, E.C.1	Terminus 3636
United Steel Companies Ltd., The	17 Westbourne Road, Sheffield, 10	Sheffield 60081
Vickers-Armstrongs Ltd.	Vickers House, Broadway, Westminster, S.W.1	Abbey 7777
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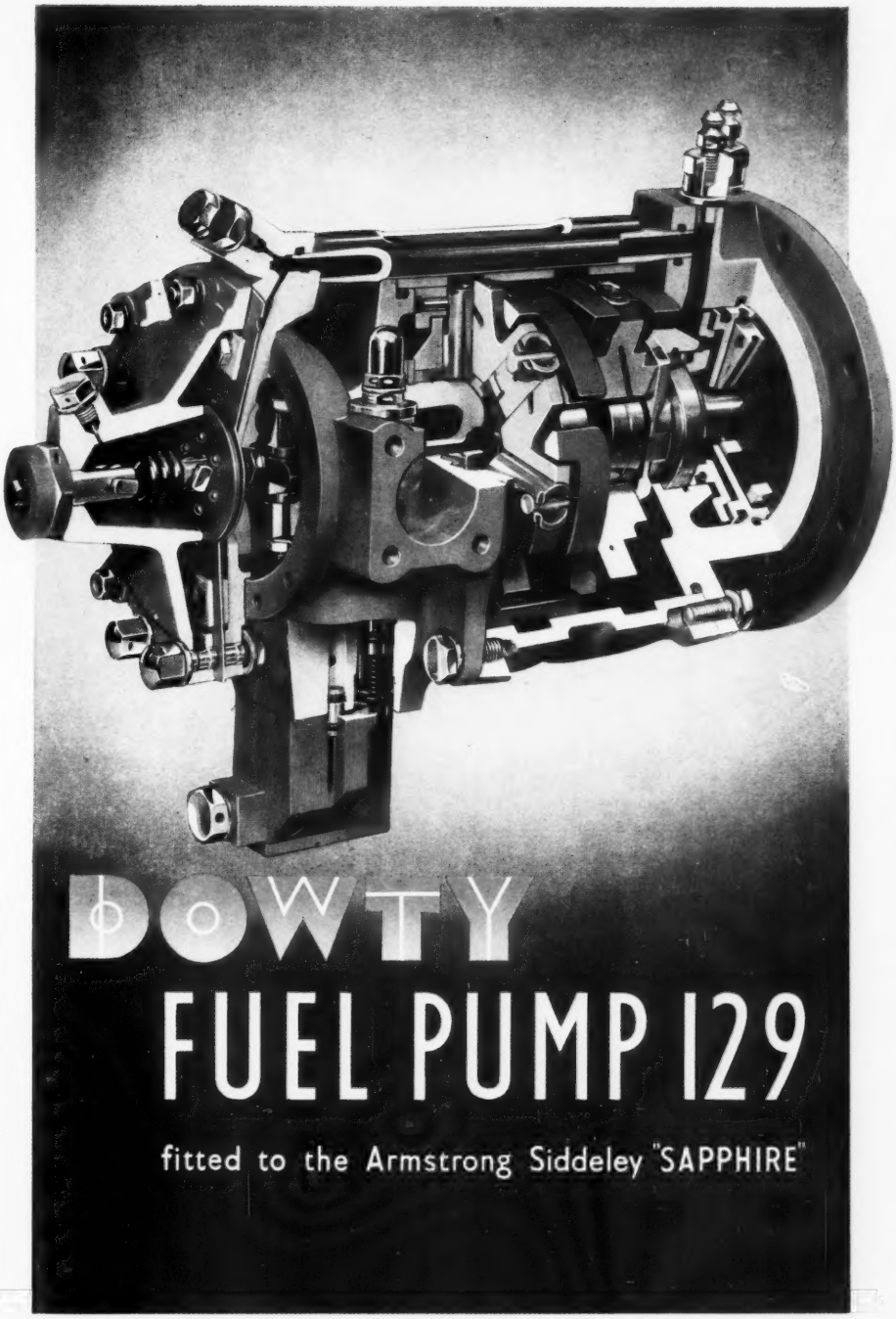
Vokes Ltd.	Henley Park, near Guildford, Surrey	Guildford 62861
Wakefield, C. C., & Co. Ltd.	46 Grosvenor Street, London, W.1	Mayfair 9232
Westland Aircraft Ltd.	Yeovil, Somerset	Yeovil 1100
Wickman Ltd.	Tile Hill, Coventry	Tile Hill 66271

The Journal is published monthly at the Offices of the Society, 4 Hamilton Place, Piccadilly, London, W.1. None of the papers or paragraphs must be taken as expressing the opinion of the Council of The Royal Aeronautical Society unless such is definitely stated to be the case. Subscriptions per annum, £6 3s. 0d., including postage: Single Numbers, 10s., or 10s. 3d. post free. All communications for publication or Advertisements in the Journal should be addressed to The Editor, and on general matters affecting the Society to The Secretary, 4 Hamilton Place, W.1. The Society's Bankers are Messrs. Coutts & Co.

Telephone: Grosvenor 3515 (5 lines). Telegraphic Address: Didaskalos, Audley, London.


DOWTY
FUEL PUMP 129
fitted to the Armstrong Siddeley "SAPPHIRE"

FARNBOROUGH

S.B.A.C. DISPLAY

1951

The A.W. Meteor N.F.11

The Avro Ashton

The Avro Shackleton

The Avro 707

The Boulton Paul Delta P.111

The English Electric Canberra

The Fairey Firefly

The Gloster Meteor

The Hawker P.1052

The Hawker P.1067

The Hawker P.1072

The Short S.A.4

The Vickers Supermarine Attacker

The Vickers Supermarine 508

The Vickers Supermarine 535

The Vickers Valiant

The Vickers Viscount

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ROLLS-ROYCE

Aero

ENGINES

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SECRETARY'S NEWS LETTER

FOR FEBRUARY 1951

THIRD ANGLO-AMERICAN AERONAUTICAL CONFERENCE SEPTEMBER, 1951

Members are asked to note that the date of the Anglo-American Conference to be held in Brighton has been put back three days and will now be held on 3rd-7th September 1951. Full particulars will be published in the next issue of the Journal.

NOMINATION OF CANDIDATES FOR COUNCIL

The following is an extract from the By-laws:—

"The Twenty-one ordinary members (of the Council) shall be nominated and elected from among the members of the Society. At the date of their election at least ten shall be Fellows, and one at least shall be in each of the following classes: Associate Fellow, Associate and Graduate.

"Of the ordinary members of the Council, that number necessary to create seven vacancies shall retire annually. The retiring members shall be those with the longest service since their last election but they shall be eligible for re-election.

"Nominations of candidates for election to the Council must be received by the Secretary not later than 10th April in each year and shall include statements in writing by the candidates that they are willing to serve. The nomination forms shall be signed by one proposer and two seconders, all of whom shall be Voters."

Nomination forms may be obtained on application to the Secretary.

ELECTION OF FELLOWS

The attention of members is drawn to the following extract from the By-Laws:—

"Elections to Fellowship will be made annually by the Council and will be announced at the Annual General Meeting of the Society. Nominations will be initiated by the members of the Council or by any four Fellows of the Society. It is the duty of the Council to see that the honour is awarded only to persons who have attained a considerable degree of technical eminence in the profession of aeronautics."

Nominations initiated by any four Fellows of the Society should be received by the Secretary on or before 15th April 1951 to give sufficient time for the Council to consider them in time for announcement at the Annual General Meeting in May.

CONTENTS OF FEBRUARY JOURNAL

Aircraft Metallic Materials Under Low Temperature Conditions, Major P. L. Teed, F.R.Ae.S.

Rockets and Assisted Take-off. A. V. Cleaver, A.R.Ae.S.

The Human Factor in Aircraft Accidents, Group Captain J. A. Newton, A.F.C., A.R.Ae.S.

Note on the Distortion Characteristics of Swept and Cranked Wings in Relation to Flutter and other Aeroelastic Phenomena, D. Williams, D.Sc., M.I.Mech.E., A.F.R.Ae.S.

The Council are particularly anxious to encourage members of the Society to support their own Journal by contributions to it of articles and papers on any aspect of Aeronautics. For that purpose they have set aside £250 a year in the form of premium awards to the authors (members or non-members) of such papers as some reimbursement for the work which has been done by the author. These premium awards are not fixed but vary from five to twenty guineas normally. It is hoped therefore that those members who have written papers on their special subjects will consider their own Journal in the first place.

THE AERONAUTICAL QUARTERLY VOLUME II, PART IV

Part IV, Volume II of "The Aeronautical Quarterly" will be available from the offices of the Society towards the end of February at 7s. 9d. a copy to members of the Society, post-paid, or 10s. 3d. to non-members, post-paid.

The Contents of Part IV will be:—

Supersonic Flow Investigations with a "Hydraulic Analogy" Water Channel	Joseph Black and O. P. Mediratta
Contracting Ducts of Finite Length	L. G. Whitehead, L. Y. Wu and M. H. L. Waters
The Properties of Crossed Flexure Pivots and the Influence of the Point at which the Strips Cross	W. H. Wittrick
An Analysis of the Lift on Straight, Yawed and Swept-back Wings	J. Lockwood Taylor
Index to Volume II.	

Copies of the rest of Volume II, Parts I, II and III and a few copies of Volume I, Parts I to IV are still available, but members are reminded that a strictly limited edition only of "The Aeronautical Quarterly" is printed and numbers cannot be reprinted in any circumstances. An annual subscription therefore is advisable.

NEW YEAR HONOURS

The following members were included in the New Year's Honours List:—

ORDER OF MERIT

Marshal of the Royal Air Force The Rt. Hon. Hugh Viscount Trenchard (*Honorary Fellow*)

G.C.B.

Air Chief Marshal Sir James Milne Robb (*Associate Fellow*)

K.C.B.

H. M. Garner (*Fellow*)

C.B.E.

Acting Air Vice-Marshal T. N. McEvoy (*Associate Fellow*)
H. Constant (*Fellow*)
J. E. Serby (*Fellow*)

M.B.E.

P. R. Allison (*Associate Fellow*)
J. C. C. Taylor (*Associate*)

A.F.C.
S/Ldr. R. A. Watts (*Associate Fellow*)

MEMBERS' NEW APPOINTMENTS

C. J. Carter (*Associate Fellow*)—Assistant Director of Instrument Research and Development at the London Headquarters of the Ministry of Supply.
J. H. Forrington (*Associate*)—Works Manager at Anthony Hoists Ltd.
J. A. R. Kay (*Associate*)—Director of A. V. Roe & Co. Ltd.

LIAISON WITH OTHER SOCIETIES

The following Representatives have recently been appointed by the Council:—

The Educational Policy Committee of the City and Guilds of London Institute—Sir Arthur Gouge.
The Engineering Joint Council—Major G. P. Bulman (President of the Society).
The Board of Governors of the College of Aeronautics—Sir A. H. Roy Fedden and Dr. H. Roxbee Cox.

It is regretted that in error last month the President, Major G. P. Bulman, was stated to be the Society's representative on The Educational Policy Committee of the City and Guilds of London Institute, whereas the representative of the Society on this Committee is in fact, Sir Arthur Gouge.

SCHOLARSHIPS AWARDED BY THE SOCIETY

The attention of members is drawn to the following scholarships awarded by the Society:—

The Royal Aeronautical Society Charter Scholarship.—A Scholarship, or Scholarships, up to the value of £300 a year can be awarded and these scholarships, in the first instance, will be awarded for a period of one year, although an extension of the Scholarship for a second year will be looked upon favourably by the Council if it is clear that the student and the work would benefit by such an arrangement.

The Geoffrey de Havilland Memorial Scholarship.—A Scholarship, or Scholarships, up to the value of approximately £120 a year for a period of one year, although an extension of the Scholarship for a second year will be looked upon favourably by the Council if it is clear that the student and the work would benefit by such an arrangement.

The general regulations for both scholarships are as follows:—

The Scholarships shall be awarded annually, or at such other times as may be decided by the Council, to assist a student wishing to undertake advanced work or study in aeronautics.

The Scholarships will be awarded only to those who can satisfy the Council that they have the necessary qualifications to benefit, and whose proposals for work or further studies are acceptable to the Council. Normally, the work should lead to some higher degree or post-graduate diploma, although this is not essential.

The Council will select from the applicants those whom it considers suitable, and will call such applicants for interview in the offices of the Society before such Board as may be decided by the Society.

Students wishing to apply for the Scholarships should write to the Secretary of the Society not later than 1st June, stating the course they intend to follow, and giving full particulars of their age and the results of any examinations taken by them.

SOCIETY OF BRITISH AIRCRAFT CONSTRUCTORS EDUCATIONAL GRANTS

A number of Educational Grants are awarded by the Society of British Aircraft Constructors to boys between the ages of 16½ and 18, for the assistance of young men who are unable, for financial reasons, to take up a course of education fitting them to become aircraft engineers.

The value of the scholarship will depend upon the circumstances of the holder. The intention of the Society is to supplement the scholarship holder's means (taking into account the payment made by the employer) up to an amount which, in the opinion of the Selection Committee, will be sufficient to enable the holder to maintain himself during his training.

Application forms may be obtained from the Royal Aeronautical Society, 4 Hamilton Place, London, W.1.

NEWS OF BRANCHES

The President and Secretary visited the Weybridge Branch of the Society on 29th December on the occasion of the Annual Dance of the Branch. The President also visited the Portsmouth Branch on 1st February.

FOURTH LOUIS BLERIOT LECTURE

The Fourth Louis Bleriot Lecture will be given on Friday, 23rd February 1951 on "Power versus Weight in Aviation" by Monsieur Maurice Roy. The Lecture will be held at 6 p.m. at the Institution of Civil Engineers, Great George Street, Westminster, S.W.1.

THE "ARCHITECTURE" OF TRANSPORT

An exhibition entitled the "Architecture of Transport" and showing by means of photographs, plans and models, the architect's work in road, rail, water and air transport, will be held from 22nd February to 22nd March 1951 at the Royal Institute of British Architects, 66 Portland Place, W.1.

LECTURES—SPRING 1951

MAIN LECTURES

(At 6 p.m. in the Lecture Hall of the Institution of Civil Engineers, Great George Street, London, S.W.1, unless otherwise stated. Tea will be served at 5.30 p.m.)

Thursday, 15th February 1951—AT COVENTRY—Some Aspects of Flight Research, Handel Davies, M.Sc., F.R.Ae.S.—*at Sibree Hall, at 7.30 p.m.*

Friday, 23rd February 1951—FOURTH LOUIS BLERIOT LECTURE. Power versus Weight in Aviation, M. Roy.

Thursday, 1st March 1951—Progress Towards Electrical Serviceability, R. H. Woodall, A.F.R.Ae.S., and W. A. Higgs.

Thursday, 15th March 1951—Progress Towards Hydraulic Serviceability, H. G. Conway, M.A., M.I.Mech.E., F.R.Ae.S., and R. H. Bound, F.R.Ae.S.

Thursday, 29th March 1951—Some Aspects of Modern Naval Aircraft Design, D. L. Hollis Williams, B.Sc., F.R.Ae.S.

Thursday, 12th April 1951—Planning and Production Methods as Applied to the Comet, H. Povey, A.F.R.Ae.S.

Thursday, 26th April 1951—A DISCUSSION. Air Travel from the Passenger's Point of View.

SECTION LECTURES

(At 7 p.m. in the Library of the Royal Aeronautical Society, 4 Hamilton Place, London, W.1, unless otherwise stated.)

Tuesday, 13th February 1951—Derivation and Estimation of Aerodynamic Loads for Stressing Purposes, D. J. Lambert, A.F.R.Ae.S.

Tuesday, 27th February 1951—Development in Aircraft Wheels, Tyres and Brakes, J. Wright, F.R.Ae.S.

Tuesday, 6th March 1951—Problems of Pilot Ejection Seats, J. Martin, O.B.E.

Tuesday, 10th April 1951—Simulators, W. R. Thomas, B.Sc., A.M.I.E.E.

GRADUATES' AND STUDENTS' LECTURE

(At 7.30 p.m. in the Library of the Royal Aeronautical Society, 4 Hamilton Place, W.1, unless otherwise stated. Visitors are welcome to attend.)

Thursday, 8th March 1951—Practical Design for High $M_{CRIT.}$, G. H. Lee, B.Sc., D.I.C., A.R.C.S., F.R.Ae.S.

BRANCH LECTURES AND NOTICES

Notices of Branch Lectures and Meetings for inclusion in the Monthly Notices of the Society must be received by the 20th of the preceding month. The Honorary Secretaries of all Branches are asked to inform the Society of their arrangements for meetings so that a complete list of Branch meetings may be given.

BELFAST BRANCH

Tuesday, 27th February 1951—Aircraft Carriers—Problems Associated with the Operation of Aircraft, J. L. Bartlett.

Tuesday, 13th March 1951—Radar—How it Works, B. W. Hodlin, B.Sc.(Hons.).

Tuesday, 3rd April 1951—Annual General Meeting.

In the Central Hall, College of Technology, Belfast, at 7 p.m.

BIRMINGHAM BRANCH

Friday, 30th March 1951—Flying the Brabazon, A. J. Pegg, O.B.E. At the Chamber of Commerce, Birmingham, 7.30 p.m.

Friday, 27th April 1951—Annual General Meeting. At White Horse Hotel, Birmingham.

BRISTOL BRANCH

Wednesday, 14th February 1951—Civil Engineering and Aeronautics, A. G. Pugsley, O.B.E., D.Sc., F.R.Ae.S.

Tuesday, 27th February 1951—Human Factors in the Design and Operation of Civil Air Transport Aircraft, Kenneth G. Bergin, M.A., M.D., D.P.H., A.F.R.Ae.S.

Monday, 12th March 1951—Junior Members' Papers Competition.

Wednesday, 4th April 1951—Power Plant Requirements for Future Aircraft. F. M. Owner, C.B.E., M.Sc., F.R.Ae.S., M.S.A.E.

Tuesday, 17th April 1951—Some Notes on Overhaul and Maintenance, C. H. Jackson, B.Sc., A.C.G.I., A.F.R.Ae.S., A.M.I.Mech.E.

Monday, 30th April 1951—Annual General Meeting and Film Show.

In the Conference Room, Filton House, The Bristol Aeroplane Co. Ltd. at 6 p.m., unless otherwise stated.

BROUGH BRANCH

Wednesday, 14th February 1951—A Talk on Aero-Engines, Air Commodore F. R. Banks, C.B., O.B.E., F.R.Ae.S.

Wednesday, 14th March 1951—Aircraft Structures, P. B. Walker, M.A., Ph.D., F.R.Ae.S.

In the Lecture Hall, Electricity Showrooms, Ferensway, Hull, at 7.30 p.m. Admission is by ticket only.

COVENTRY BRANCH

Thursday, 15th February 1951—25th Anniversary Lecture (Main Lecture of the R.Ae.S.)—Some Aspects of Flight Research, Handel Davies, M.Sc., F.R.Ae.S.—*at Sibree Hall, at 7.30 p.m.*

Wednesday, 18th April 1951—Annual General Meeting and Films. In the Wine Lodge Hotel, The Burges, Coventry, at 7.30 p.m.

DERBY BRANCH

Monday, 12th March 1951—The Cierva Air Horse, J. S. Shapiro, Dipl. Ing., A.F.R.Ae.S.

Monday, 2nd April 1951—The Evolution of the Design of a Jet Engine, A. A. Lombard, A.F.R.Ae.S.

Monday, 7th May 1951—Long Range Turbo-Jet Transport, A. E. Russell, B.Sc., F.R.Ae.S.

In the Rolls-Royce Welfare Hall, Nightingale Road, Derby, at 6.15 p.m.

GLASGOW BRANCH

Thursday, 22nd February 1951—Thin Walled Structures, Dr. R. M. Kenedi, Ph.D., A.M.I.Mech.E., A.F.R.Ae.S. At Royal Technical College, Glasgow.

Thursday, 22nd March 1951—Gas Turbines, L. Haworth, B.Sc., A.M.I.Mech.E. At Rolls-Royce Factory, Hillington, Glasgow.

Meetings will begin at 7.30 p.m.

GLOUCESTER AND CHELTENHAM BRANCH

Wednesday, 28th February 1951—Films—at Wheatstone Hall, City Library, Brunswick Road, Cheltenham—at 7.30 p.m.

Saturday, 3rd March 1951—*Visit* to De Havilland's, Hatfield.

HALTON BRANCH

Monday, 19th February 1951—Films.

Wednesday, 21st February 1951—*Visit*—National Physical Laboratory (Provisional).

Monday, 26th February 1951—Cabin Air Control, Corporal Apprentice J. H. Ansley.

Monday, 5th March 1951—The Case for the Flying Boat, D. Keith-Lucas, F.R.Ae.S.

Wednesday, 7th March 1951—*Visit*—Air Trainers Ltd.

Monday, 12th March 1951—Aircraft Icing Problems, Corporal Apprentice F. L. Maitland-Titterton and Corporal Apprentice E. Davies.

Monday, 19th March 1951—Brains Trust.

At Branch Headquarters, Halton, at 6.45 p.m., unless otherwise stated.

ISLE OF WIGHT BRANCH

Thursday, 22nd February 1951—Interplanetary Flight—(The Rocket Engineer's Point of View), A. V. Cleaver, A.R.Ae.S. (This Lecture is complementary to that given on 1st November 1950.)

Thursday, 8th March 1951—Methods of Time Keeping, Dr. R. d'E. Atkinson.

Thursday, 22nd March 1951—Junior Branch Prize Lecture.

In the Saunders-Roe Sports and Social Club, at 6 p.m.

LEICESTER BRANCH

Wednesday, 21st February 1951—Welded Magnesium Aircraft Structures, R. J. Cross.

Wednesday, 7th March 1951—The Island Campaign (Coloured Film), W. Courtenay, O.B.E., M.M., A.R.Ae.S.

Friday, 13th April 1951—Rockets and Space Travel, J. Humphries, B.Sc., A.M.I.Mech.E., A.F.R.Ae.S.

In Room 104, College of Technology, The Newarkes, Leicester, at 7.15 p.m.

LUTON BRANCH

Wednesday, 7th March 1951—De-Icing and Anti-Icing Systems, D. Rendel, B.Sc.

Wednesday, 2nd May 1951—Plastics in Aircraft, J. Byers.

Wednesday, 23rd May 1951—Film Show and Discussion Evening.

At the George Hotel, Luton, at 7.30 p.m.

MANCHESTER BRANCH

Wednesday, 28th February 1951—Film: Steelmaking and Usages. (Thos Firth & John Brown Ltd. and Firth-Vickers Stainless Steels Ltd.).

Thursday, 29th March 1951—Cabin Air Conditioning, W. M. Widgery, F.R.Ae.S.

In the Reynolds Hall, College of Technology, Manchester, at 7.30 p.m.

PORTSMOUTH BRANCH—FILM PROGRAMME

Thursday, 15th February 1951—'Pluto' and 'Welded Structure' (Stewarts & Lloyds and Dorman, Long & Co. Ltd.).

Thursday, 1st March 1951—Wood (CFL Films, and Aims of Industry Film).

Thursday, 15th March 1951—Casting and Forging Light Alloys (High Duty Alloys).

Thursday, 29th March 1951—Annual General Meeting.

At the Apprentices' School, Airspeed Ltd., The Airport, Portsmouth, at 6 p.m.

SOUTHAMPTON BRANCH

Wednesday, 21st February 1951—Aircraft Undercarriages, R. C. Cussons, M.A.

Wednesday, 21st March 1951—The Further Development of the Brabazon Type, G. P. Hebden, B.Sc., A.F.R.Ae.S.

Wednesday, 11th April 1951—Instrumentation for Testing Aircraft and Aero-Engines, C. Jaques (Joint meeting with Southern Branches of Institution of Mechanical Engineers and Institution of Electrical Engineers).

In the Physics Lecture Theatre, University College, at 7 p.m.

WEYBRIDGE BRANCH

Wednesday, 21st February 1951—Some Problems of Air Interception, Air Vice-Marshal T. G. Pike, C.B., C.B.E., D.F.C.

Wednesday, 14th March 1951—Turbine-Engined Aircraft, G. R. Edwards, M.B.E., B.Sc., F.R.Ae.S., A.M.I.Struct.E.

Wednesday, 4th April 1951—Gas Turbines, S. G. Hooker, O.B.E., A.R.C.Sc., B.Sc., D.I.C., D.Phil., F.R.Ae.S., F.R.S.A.

Wednesday, 18th April 1951—Junior Prize Lecture, Branch Members.

Wednesday, 2nd May 1951—Annual General Meeting and Smoking Concert.

At Vickers-Armstrongs Ltd., Weybridge, at 6 p.m.

ANNUAL SUBSCRIPTIONS

Members are reminded that their annual subscriptions became due on 1st January 1951. The rates are:—

	Home	Abroad
	£ s. d.	£ s. d.
Fellows	5 5 0	4 4 0
Associate Fellows	4 4 0	3 3 0
*Associates	3 3 0	3 3 0
Graduates (aged under 26) ...	2 2 0	2 2 0
Graduates (aged 26 and over) ...	2 12 6	2 12 6
Students (aged under 21) ...	1 1 0	1 1 0
Students (aged 21 and over) ...	1 11 6	1 11 6
Companions	3 3 0	3 3 0
Founder Members	2 2 0	2 2 0

* Any Associate elected before 1st October 1947 may, if he wishes, elect not to receive the JOURNAL, and in this case his subscription will be reduced by £1 1s. 0d. to £2 2s. 0d.

It will avoid delay and confusion if members, when sending remittances for subscriptions, will state their names clearly and give their addresses and grades of membership.

Remittances should be made payable to the Royal Aeronautical Society.

ELECTIONS

The following is a list of new members and transfers of membership of the Society:—

Associate Fellows

Frank Harry Bond (from Graduate), Raymond Montrose Brown (from Graduate), Robert Ellis Chapman (from Associate), Charles Leslie Dann, Ernest James Grewcock (from Graduate), Charles Henry Johns (from Associate), Hiram Oliver West, Thomas George Holmes Woolford (from Graduate).

Associates

Rex Norman Spurden Burley, John Henry Hotson, Charles Edward Hutt, Ian David Kitson, Ernest Sidney Moore, Alfred Arthur Old, Mathew Alexander Ernest Quinn.

Graduates

Robert Edward Finch (from Student), Gordon Robert Parker (from Student), John Michael Ramsden, Peter Travers Ross (from Student), Hitendra Nath Roy, Soli Kaikhushru Sahiar (from Student), Barnes Winstanley Wallis, Jesus Ernest Vargas (from Student).

Students

Henry William Groves, Ian Harwood, John Ernest Walford.

JOURNAL OF THE ROYAL AERONAUTICAL SOCIETY

It is regretted that with the increasing costs of production it has been found necessary to increase the price of the JOURNAL OF THE SOCIETY.

From January 1951 (Volume LV, Number 481) the price was increased from 7s. 6d. to 10s. 0d. for each number.

The new rates from January 1951 therefore are:—

Single Copies: 10s. 3d. each including postage (home or abroad)
Annual Subscription: £6 3s. 0d. including postage (home or abroad)

JOURNAL BINDING

The prices of binding of Journals are as follows:—

1950 Volume (including packing and postage), 16s. 0d.

Previous Volumes (including packing and postage), 18s. 0d.

Journals, with a note of the name and address of the sender, should be sent direct to The Lewes Press, Friars Walk, Lewes, Sussex, and the remittance to the Secretary at the offices of the Society.

Cases only for unbound 1950 Volumes are available, price 6s. 6d. each. Requests for cases, with remittances, should be sent to the Secretary at the offices of the Society.

CHANGES OF ADDRESS

To assist in keeping the records of members correct and up to date the Secretary will be glad if all members will notify him as soon as possible of changes of address.

When notifying changes please give the following particulars:—

Name (in block letters).
Grade of membership.
New address (in block letters).
Old address.

Changes of address must be received *before the 15th of the month* in order to be effective for the Journal for the following month.

ACKNOWLEDGMENT

The Council acknowledge with grateful thanks the return of back numbers of the Journal from A. Dennison Scarlett, Esq., *Associate Fellow*.

ADDITIONS TO THE LIBRARY

The following have been added to the Library (titles of pamphlets are printed in italics. Books marked * or ** may not be taken out on loan):—

Bakan, D. and E. S. Ewart	Visual Deficiency and Flying Experience Following Flight Training. Civil Aeronautics Administration. 1950.
Bicknell, R.	Air Rescue and Survival. (a paper). Aviation Forum. 1951.
*British Standards Institution	Engineering Drawing Office Practice. B.S.I. 1943.
Casamassa, J. V.	Jet Aircraft Power Systems. McGraw Hill. 1950.
Chalmers, B.	The Structure and Mechanical Properties of Metals. (Volume II of a series of Monographs on Materials published under the authority of the Royal Aeronautical Society). Chapman & Hall. 1951.
Civil Aeronautics Administration	Statistical Handbook of Civil Aviation. U.S. Government Printing Office. 1949.
Dorman, G.	British Test Pilots. Forbes Robertson. 1950.
Engel, H. C. et al	Structural Plastics. McGraw Hill. 1950.
Glasstone, S.	Sourcebook on Atomic Energy. Macmillan. 1950.

Industrial Diamond Information Bureau	Bibliography of Diamond as Cutting Tool for Metals and Non-Metallic Materials. 1950.
Lubbock, I.	Combustion Problems of the Gas Turbine (preprint). N.E. Coast Inst. Eng. & Shipbuilders. 1951.
Palmer, D. and A. C. Penney	Aircraft. Arnold (Merlin Books). 1949.
Porter, A.	Introduction to Servo-Mechanisms. Methuen. 1950.
Sibert, H. W.	High Speed Aerodynamics. Prentice-Hall. 1948.

A.R.C. Reports and Memoranda

2346—*Force and pressure coefficients up to Mach number* 0.87 *on the Goldstein roof-top section* 1442/1547. *H. H. Pearcey and J. A. Beavan.*
2348—*Research handling tests on "Blenheim" L*6595. *M. B. Morgan.*
2349.—*Notes on the turning performance of the Spitfire as affected by altitude and flaps. M. B. Morgan and D. E. Morris.*
2361—*Messerschmitt Me.*109 *handling and manœuvrability tests. M. B. Morgan and D. E. Morris.*
2374—*Wind-tunnel tests on the exhaust and propeller interference drag of a Merlin universal power plant installed on a wing. K. G. Winter and J. Dorward.*
2379—*Handling tests on the Curtiss H-*75, *and comparative aileron tests on the Curtiss H-*75, *Spitfire and Gloster F.*5/34. *M. B. Morgan, D. E. Morris and F. J. Bigg.*
2392—*Routine computing methods for stability and response investigations on linear systems. H. R. Hopkin.*
2405—*Stresses in a stiffened circular cylinder under concentrated axial loads. D. C. Allen.*
2413—*Tests on a* 5 *per cent. biconvex aerofoil in the compressed air tunnel. D. H. Williams and A. H. Bell.*
2415—*A general survey of the effects of flexibility of the fuselage, tail unit and control systems on longitudinal stability and control. H. M. Lyon and J. Ripley.*
2486—*The resistance of aluminium and beryllium bronzes to fatigue and corrosion-fatigue. D. G. Sopwith.*

Thornton Research Centre. Aero-Engine Laboratory. Report.

M.77/50—*The use of tricresyl phosphate as an aviation gasoline additive. A. R. Griffin.*

Aeronautical Research Laboratories. Australia.

Aerodynamics Note.

87—*Some characteristics of a turbulent boundary layer in the vicinity of a suction slot. R. A. Wallis.*

Report SM.

159—*An investigation of the copper brazing of steel. C. J. Osborn and S. T. M. Johnstone.*

Structures and Materials Note.

182—*Tests on sandwich nose sections. C. M. Bailey and others.*

Office national d'études et de recherches aéronautiques. France. Publications.

41—*Représentations graphiques des coefficients aérodynamiques instationnaires et tables de Küssner-Jordan. R. Weber.*
44—*Notions fondamentales d'aerothermodynamique. M. Roy.*

45—*Écoulements tourbillonnaires dans les machines axiales. R. Siestrunck and J. Fabri.*
46—*Spectrographie d'émission. A. Moutet and S. Barrère.*
47—*Calcul approché de la couche limite laminaire en écoulement compressible sur une paroi non conductrice de la chaleur. E. Gruschwitz. Application numérique et discussion. E. A. Eichelbrenner.*

Ministère de l'air. France. Publications scientifiques et techniques.

N.T.40—*L'hydratation et les phénomènes accompagnant l'hydratation du sulfate de quinine. M. Prost.*

National Aeronautical Research Institute. Holland. Report (in English).

S.362—*Load distribution and relative stiffness parameters for a reinforced circular cylinder containing a rectangular cut-out. L. S. D. Morley and W. K. G. Floor.*

Aeronautical Research Institute. Sweden. Reports.

20—*Undersokning av turbulensens inverkan pa omslagspunktens läge pa en vingprofil. G. Drougge.* (*English abstract*: *An investigation of the influence of turbulence on the transition point of an aerofoil.*)
21—*Jämförelse mellan olika metoder för utvärdering av profilmotstand ur impulsmätning vid höga hastigheter G. Drougge.* (*English abstract*: *Comparison between different methods of calculating the profile drag as determined by the pitot traverse method at high speeds.*)
22—*Some basic characteristics of wire strain gauges and bridge circuits for these gauges. G. V. A. Gustafsson.* (*In English.*)

Royal Institute of Technology. Sweden. Aero Technical Notes. (In English).

16—*Similarity laws for hypersonic flow. K. Oswatitsch.*
19—*Wind tunnel interference due to lift for delta wings of small aspect ratio. S. B. Berndt.*

Civil Aeronautics Administration. U.S.A. Technical Development Reports.

113—*The CAA VHF Omnirange. H. C. Hurley, S. R. Anderson and H. F. Keary.*
114—*UHF distance measuring equipment for air navigation. R. C. Borden, C. C. Trout and E. C. Williams.*
115—*The phase comparison localiser. S. E. Taggart and V. E. Willey.*

J. LAURENCE PRITCHARD,
Secretary,

THE ROYAL AERONAUTICAL SOCIETY
4 Hamilton Place, Piccadilly, London, W.1. Tel.: Grosvenor 3515-19

Made and printed in Great Britain by THE LEWES PRESS Friars Walk, Lewes, Sx.

THE ROYAL AERONAUTICAL SOCIETY

GRADUATES' AND STUDENTS' SECTION

February 1951

SOME NOTES ON THE TERMS "*g*" AND "INERTIA"

By M. C. CAMPION, B.Sc.(Eng.), Grad.R.Ae.S.

PART IV

(*The previous parts of this paper appeared with the August, October, November and December* 1950, *and January* 1951 *issues of the* JOURNAL)

IV—*Some consequences of the flexibility of the structure*

(*i*) Parts I to III of this paper described the methods used for determining the inertia factors for any part of a rigid aircraft. The assumption of a rigid structure implies that no part of the structure can deflect relative to any other part, and that a load applied to one part affects every other part.

If the structure cannot be regarded as rigid, then this is no longer true, and a load applied to one part of the aircraft may only affect that part of the structure. If this is so, then the applied load must be "reacted" by the inertia of that part and not by the inertia of the whole aircraft. This implies that the inertia factors (and the accelerations) for that part will be higher than those for a rigid aircraft.

The applied load may act only for a brief time, in which case the inertia loads will tend to be as described in the previous paragraph; but if the time of action is great, the effects will approach those on a rigid aircraft.

(*ii*) The time history of the application of the load also has far-reaching effects on a flexible aircraft. If the load is applied slowly, then the structure will deflect until the equilibrium position (corresponding to static loading) is reached.

A load applied suddenly, however, will cause the structure to deflect beyond the position of equilibrium, and it will then oscillate about that position until the damping in the system reduces the oscillations to zero. If the stiffness is very low, the effect will be similar to that of a load suddenly applied to a spring, the maximum deflection being twice the static deflection.

In practice, the effect of the time of application will be between the "static" and "suddenly applied" conditions, and must be examined individually, according to the actual time-history of the load and the actual structural characteristics. The criterion by which the time of application is regarded as "long" or "short" is the natural frequency of the appropriate mode of vibration of the structure.

(*iii*) When the time of build-up of the load is equal to the natural frequency, very large deflections can occur, leading to the phenomenon known as "resonance."

As the structure deflects (if it is in the air stream) the aerodynamic loading may change, since the deflection can change the local incidence, and this change of load may cause a rapid oscillation of the structure. If the damping in the system is low, the oscillations will not be suppressed, and "flutter" will result.

Similar oscillations may also occur if there is some pulsating force of a mechanical origin, such as engine vibration or slipstream pulsation. These oscillations may be rapidly damped or may persist, but since they are not the result of the interaction of aerodynamic, elastic and inertia forces only, they are not described as flutter, but as "mechanical vibration."

[P.T.O.

(*iv*) If a c n system of applied aerodynamic loads causes the structure to deflect from its original shape, the incidence of the wing or tailplane will be changed, and this will lead to a modification of the applied loads. This, in turn, causes further deflections, which again modify the loading, and so on, until the position of equilibrium is reached.

This "aeroelastic distortion" can have serious consequences on a high-speed aircraft, since it sometimes leads to a loss of lift on the wing tips (which might cause root-stalling) and to a loss of stability and control.

While the effects of wing deflection are the most marked, fuselage flexibility cannot be ignored. If a down-load occurs on the tailplane, the fuselage will bend in such a direction as to increase the tailplane incidence and therefore reduce the down-load. This means that a given elevator movement will cause a smaller tail load on a flexible aircraft than on a rigid one.

(*v*) The procedure for determining the loads in a flexible aircraft must, therefore, be different from that used for a rigid aircraft, and generalised stressing cases, as used in the past, are no longer sufficiently accurate.

In gust cases, high-speed aircraft will have to be examined individually for a series of types of gust, the gradients and durations being specified.

For manoeuvring cases, the effects of a given stick force (or control movement) will have to be studied, the response being calculated for a certain rate of movement of the control surface.

Landing and take-off cases will be treated in a similar manner to the flight cases, the time-history of the undercarriage loads being specified or calculated.

References

Since a paper of this length cannot deal fully with any one aspect of the subject, the following list of references is appended. Many of them contain extensive bibliographies which will be of value to those wishing to pursue the subject further.

Journal of the Royal Aeronautical Society

August 1946: Collar, A. R. The Expanding Domain of Aeroelasticity.

January 1947: Collar, A. R. Aeroelastic Problems at High Speed.

April 1947: Walker, P. B. Mechanical Vibration and Aeroelasticity.

September 1947: Pugsley, A. G. The Behaviour of Structures Under Repeated Loads.

" " Tye, W. Gusts.

March 1948: Hill, G. T. R. The Nature of the Distortion of Swept-back Wings.

August 1948: Tye, W. The Influence of Recent Civil Airworthiness Requirements on Aircraft Design.

June 1949: Duncan, W. J. Flutter and Stability.

December 1949: Harpur, N. F. The Determination of Vibration Modes.

A.R.C. Reports and Memoranda

1155: Frazer, R. A. and Duncan, W. J. The Flutter of Aeroplane Wings.

1255: Frazer, R. A. and Duncan, W. J. The Flutter of Monoplanes, Biplanes and Tail Units.

1716: Duncan, W. J., Collar, A. R. and Lyon, H. M. Oscillations of Elastic Blades and Wings in an Airstream.

1839: Pugsley, A. G. A Simplified Theory of Wing Flutter.

2097: Montagnon, P. E., Robinson, A. and Fagg, S. V. A Note on the Interpretation of *V-g* Records.

2117: Jones, W. Prichard. Aerodynamic Forces on Wings in Non-uniform Motion.

2121: Williams, D. and Jones, P. N. Dynamic Loads in Aeroplanes under Given Impulsive Loads with Particular Reference to Landing and Gust Loads on a Large Flying Boat.

2275: Bryant, L. W. and Gandy, R. W. G. The Response of an Aeroplane to Application of the Elevators.

M.O.S. Air Publication 970. Design Requirements for Aeroplanes for the R.A.F. and R.N.

A.R.B. British Civil Airworthiness Requirements.

SECRETARY'S NEWS LETTER

FOR MARCH 1951

APPOINTMENT OF THE NEW SECRETARY

The Council at their meeting of 22nd February 1951 appointed Dr. Archibald Morton Ballantyne, *Associate Fellow*, to succeed Captain J. Laurence Pritchard as Secretary of the Society.

Dr. Ballantyne (who is 42 years of age) is the Senior Lecturer in the Civil and Municipal Engineering Department of University College, London.

He was educated at Glasgow University where he took his B.Sc. degree in Engineering, and in addition to being an Associate Fellow of the Society he is an Associate Member of the Institution of Civil Engineers and an Associate Member of the Institution of Structural Engineers and a Ph.D. of Glasgow University.

Dr. Ballantyne will take over his duties as Secretary on Monday 2nd July 1951.

EASTER HOLIDAYS

The Offices and Library of the Society will be closed from 5 p.m. on Thursday 22nd March until 9 a.m. on Tuesday 27th March 1951.

GARDEN PARTY 6th MAY 1951

The Society's Annual Garden Party will be held on Sunday 6th May 1951 at White Waltham Aerodrome, near Maidenhead, by kind permission of the Ministry of Supply and the Fairey Aviation Co. Ltd. An application form for tickets, price 10s. including tea, is enclosed with this JOURNAL.

THIRD ANGLO-AMERICAN CONFERENCE

With this issue of the JOURNAL and the News Letter is given a leaflet containing particulars of the preliminary arrangements for the Conference and an enrolment form.

The Secretary, on his ten-day visit to New York to discuss the arrangements for the Third Anglo-American Aeronautical Conference, received the greatest co-operation from the Director, S. Paul Johnston, and the officials of the Institute of the Aeronautical Sciences. This co-operation extended far beyond the Secretary's suggestions on behalf of the Council of the Society, and ensures the success of the Third Anglo-American Conference. There is no doubt that these Conferences are rapidly building up a structure of Anglo-American aeronautical understanding and friendship which will stand four-square in technical endeavour against any shocks which it may have to face.

Of that friendship the Secretary has only one thing to say. It is so deep already that he has found it possible to say just those things friends can and should say without hurting. Of understanding there is this to say. Paul Johnston and his team were vividly aware of the detailed difficulties of running this third Conference in view of the general international situation, and cleared these difficulties away by their quick response to the suggestions made to them.

The Secretary had the great honour of attending the Council Dinner of the Institute, of being a guest at their Honours Night Dinner, when over 1,000 members of the Institute and their friends were present, and of being asked to explain on both occasions the arrangements being made for the September meeting.

The Secretary was invited to attend the meeting of the Council of the Institute on 31st January when the following resolution was passed:—

"RESOLVED, that the Officers and Council of the Institute of the Aeronautical Sciences send greetings to the Officers and Council of The Royal Aeronautical Society and express their great appreciation for the visit of your Secretary, Captain J. Laurence Pritchard, to discuss plans for the Third International Conference of the two societies. Our members are looking forward to renewing friendships with the members of The Royal Aeronautical Society and continuing the discussion of mutual aeronautical problems. We feel that the closest possible collaboration between the two societies is essential in this critical period of World history."

To this resolution the President replied, on behalf of the Council, as follows:—

"The great pleasure with which I received your letter of 1st February informing me of the resolution passed by the Council of the Institute of the Aeronautical Sciences on 31st January will be shared by all members of the Council of The Royal Aeronautical Society when I report its receipt to them at its next meeting on 22nd February.

"Captain Pritchard, safely returned, has given me a very full account of his conversation with you and your Council and I would be grateful if you would accept yourself, and also convey to Mr. Paul Johnston and all his staff, my deep appreciation of the many courtesies and kindnesses extended to our Secretary.

"Your discussions with him concerning the conference between our two organisations in Brighton next September encourage one to feel that that event will be in all respects successful not only in the quality and extent of our technical discussions and inter-change of thought but in its opportunity for so many old friends to re-enjoy the pleasure of each other's company.

"We shall all do our utmost to make the visit of yourself and your colleagues to this country enjoyable and satisfying. We are deeply grateful for the kind suggestion made to Captain Pritchard that you and your colleagues should act as hosts on some occasions during the period of the conference, thus further emphasising the deep friendship and understanding between us and the reality of our collaboration, which is more than ever essential, as you record, in this critical period of world history."

HONOURS AWARDED TO MEMBERS

Sir Henry Tizard, *Fellow*, has been awarded the Honorary Fellowship of the Institute of the Aeronautical Sciences. Only one such award is made in the year to a non-American. Sir Henry Tizard is Chairman of the Advisory Council on Scientific Policy and Chairman of the Defence Research Policy Committee.

Dr. Hugh L. Dryden, *Fellow*, Director of the National Advisory Committee for Aeronautics, has been awarded the 1950 Guggenheim Medal for his outstanding leadership in aeronautical research and fundamental contributions to aeronautical sciences.

NOMINATION OF CANDIDATES FOR COUNCIL

The following is an extract from the By-laws:—

"The Twenty-one ordinary members (of the Council) shall be nominated and elected from among the members of the Society. At the date of their election at least ten shall be Fellows, and one at least shall be in each of the following classes: Associate Fellow, Associate and Graduate.

"Of the ordinary members of the Council, that number necessary to create seven vacancies shall retire annually. The retiring members shall be those with the longest service since their last election but they shall be eligible for re-election.

"Nominations of candidates for election to the Council must be received by the Secretary not later than 10th April in each year and shall include statements in writing by the candidates that they are willing to serve. The nomination forms shall be signed by one proposer and two seconders, all of whom shall be Voters."

Nomination forms may be obtained on application to the Secretary.

ELECTION OF FELLOWS

The attention of members is drawn to the following extract from the By-Laws:—

"Elections to Fellowship will be made annually by the Council and will be announced at the Annual General Meeting of the Society. Nominations will be initiated by the members of the Council or by any four Fellows of the Society. It is the duty of the Council to see that the honour is awarded only to persons who have attained a considerable degree of technical eminence in the profession of aeronautics."

Nominations initiated by any four Fellows of the Society should be received by the Secretary on or before 15th April 1951 to give sufficient time for the Council to consider them in time for announcement at the Annual General Meeting in May.

CONTENTS OF MARCH JOURNAL

The Relative Merits of Centrifugal and Axial Compressors for Aircraft Gas Turbines, E. S. Moult, B.Sc., Ph.D., F.R.Ae.S., M.I.Mech.E. and H. Pearson, B.A., A.F.R.Ae.S.

Metal Adhesive Processes, F. H. Parker.

Method for Designing Wind Tunnel Contractions, R. Harrop.

A Note on the Buckling of Struts, Harold Lurie, Ph.D.

The Council are particularly anxious to encourage members of the Society to support their own Journal by contributions to it of articles and papers on any aspect of Aeronautics. For that purpose they have set aside £250 a year in the form of premium awards to the authors (members or non-members) of such papers as some reimbursement for the work which has been done by the author. These premium awards are not fixed but vary from five to twenty guineas normally. It is hoped therefore that those members who have written papers on their special subjects will consider their own Journal in the first place.

THE AERONAUTICAL QUARTERLY VOLUME II, PART IV

Part IV, Volume II of "The Aeronautical Quarterly" is now available from the offices of the Society at 7s. 9d. a copy to members of the Society, post-paid, or 10s. 3d. to non-members, post-paid.

The Contents of Part IV are:—

Supersonic Flow Investigations with a "Hydraulic Analogy" Water Channel	Joseph Black and O. P. Mediratta
Contracting Ducts of Finite Length	L. G. Whitehead, L. Y. Wu and M. H. L. Waters
The Properties of Crossed Flexure Pivots and the Influence of the Point at which the strips cross	W. H. Wittrick
An Analysis of the Lift on Straight, Yawed and Swept-back Wings	J. Lockwood Taylor
Index to Volume II.	

Copies of the rest of Volume II, Parts I, II and III and a few copies of Volume I, Parts I to IV are still available, but members are reminded that a strictly limited edition only of "The Aeronautical Quarterly" is printed and numbers cannot be reprinted in any circumstances. An annual subscription to Volume III therefore is advisable.

MEMBERS' NEW APPOINTMENTS

W. H. Cooper (*Assoc. Fellow*)—Apprenticeship Supervisor, D. Napier & Son Ltd.

G. F. P. Fox (*Assoc. Fellow*)—Supplies Development Engineer, Rolls-Royce Ltd. (Derby).

Tibor Haas (*Assoc. Fellow*)—Project Engineer with the Israel Air Force.

Air Commodore H. W. Heslop, C.B., O.B.E. (*Assoc. Fellow*)—Senior Technical Staff Officer, Bomber Command Headquarters.

Rear Admiral Casper John (*Companion*)—Flag Officer Commanding, Third Aircraft Carrier Squadron.

The Viscount Knollys (*Companion*)—British Representative, Raw Materials Central Group, Washington.

S. W. D. Lockwood (*Assoc. Fellow*)—Works Director, Sir W. G. Armstrong Whitworth Aircraft Ltd.

H. Povey (*Assoc. Fellow*)—Director of the de Havilland Aircraft Co. Ltd.

Air Commodore J. F. Titmas, C.B., C.B.E. (*Assoc. Fellow*)—Director, Aeronautical Inspection Services at the Air Ministry.

D. N. Walker (*Assoc. Fellow*)—Chief Mechanical Engineer to the National Coal Board.

NEWS OF BRANCHES

The President attended the Inaugural Meeting of the Chester Branch of the Society on 7th February 1951 and also a lecture at the Brough Branch on 14th February 1951.

The President and Secretary also attended the Main Society Lecture held at the Coventry Branch on Thursday 15th February 1951.

INVITATION TO ATTEND LECTURES BEFORE OTHER BODIES

Members of the Society are cordially invited to attend the following Lectures:

Helicopter Association:—On Saturday 17th March 1951, "Convertible Aircraft," by Captain R. N. Liptrot, C.B.E., B.A., at 4 Hamilton Place, W.1, at 2.30 p.m.

The Institution of Electrical Engineers:—On Thursday 5th April 1951, "The Development of the Electrical System on the Bristol Brabazon Mark I Aircraft," by Mr. M. J. J. Cronin, at the Institution of Electrical Engineers, Savoy Place, W.C.2, at 5.30 p.m. (Tea at 5 p.m.).

LECTURES—SPRING 1951

MAIN LECTURES

(At 6 p.m. in the Lecture Hall of the Institution of Civil Engineers, Great George Street, London, S.W.1, unless otherwise stated. Tea will be served at 5.30 p.m.)

Thursday, 15th March 1951—Progress Towards Hydraulic Serviceability, H. G. Conway, M.A., M.I.Mech.E., F.R.Ae.S., and R. H. Bound, F.R.Ae.S.

Thursday, 29th March 1951—Some Aspects of Modern Naval Aircraft Design, D. L. Hollis Williams, B.Sc., F.R.Ae.S.

Thursday, 12th April 1951—Planning and Production Methods as Applied to the Comet, H. Povey, A.F.R.Ae.S.

Thursday, 26th April 1951—A DISCUSSION. Air Travel from the Passenger's Point of View.

SECTION LECTURE

(At 7 p.m. in the Library of the Royal Aeronautical Society, 4 Hamilton Place, London, W.1, unless otherwise stated.)

Tuesday, 10th April 1951—Simulators, W. R. Thomas, B.Sc., A.M.I.E.E.

GRADUATES' AND STUDENTS' LECTURE

(At 7.30 p.m. in the Library of the Royal Aeronautical Society, 4 Hamilton Place, W.1, unless otherwise stated. Visitors are welcome to attend.)

Thursday, 5th April 1951—Model Tests in the R.A.E. Spinning Tunnel and the Prediction of Full Scale Spin Characteristics, D. J. Harper, B.Sc.(Eng.), A.F.R.Ae.S.

Thursday, 19th April 1951—Boundary Layer Control, E. D. Poppleton, M.Sc.

BRANCH LECTURES AND NOTICES

Notices of Branch Lectures and Meetings for inclusion in the Monthly Notices of the Society must be received by the 20th of the preceding month. The Honorary Secretaries of all Branches are asked to inform the Society of their arrangements for meetings so that a complete list of Branch meetings may be given.

BELFAST BRANCH

Tuesday, 13th March 1951—Radar—How it Works, B. W. Hodlin, B.Sc.(Hons.).

Tuesday, 3rd April 1951—Annual General Meeting.

In the Central Hall, College of Technology, Belfast, at 7 p.m.

BIRMINGHAM BRANCH

Friday, 30th March 1951—Flying the Brabazon, A. J. Pegg, O.B.E. At the Chamber of Commerce, Birmingham, 7.30 p.m.

Friday, 27th April 1951—Annual General Meeting. At the White Horse Hotel, Birmingham.

BRISTOL BRANCH

Monday, 12th March 1951—Junior Members' Papers Competition.

Wednesday, 4th April 1951—Power Plant Requirements for Future Aircraft. F. M. Owner, C.B.E., M.Sc., F.R.Ae.S., M.S.A.E.

Tuesday, 17th April 1951—Some Notes on Overhaul and Maintenance, C. H. Jackson, B.Sc., A.C.G.I., A.F.R.Ae.S., A.M.I.Mech.E.

Monday, 30th April 1951—Annual General Meeting and Film Show.

In the Conference Room, Filton House, The Bristol Aeroplane Co. Ltd. at 6 p.m., unless otherwise stated.

BROUGH BRANCH

Wednesday, 14th March 1951—Aircraft Structures, P. B. Walker, M.A., Ph.D., F.R.Ae.S.

In the Lecture Hall, Electricity Showrooms, Ferensway, Hull, at 7.30 p.m. Admission is by ticket only.

COVENTRY BRANCH

Wednesday, 18th April 1951—Annual General Meeting and Films. In the Wine Lodge Hotel, The Burges, Coventry, at 7.30 p.m.

DERBY BRANCH

Monday, 12th March 1951—The Cierva Air Horse, J. S. Shapiro, Dipl. Ing., A.F.R.Ae.S.

Monday, 2nd April 1951—The Evolution of the Design of a Jet Engine, A. A. Lombard, A.F.R.Ae.S.

Monday, 7th May 1951—Long Range Turbo-Jet Transport, A. E. Russell, B.Sc., F.R.Ae.S.

In the Rolls-Royce Welfare Hall, Nightingale Road, Derby, at 6.15 p.m.

GLASGOW BRANCH

Thursday, 22nd March 1951—Gas Turbines, L. Haworth, B.Sc., A.M.I.Mech.E.
At Rolls-Royce Factory, Hillington, Glasgow.
Meetings will begin at 7.30 p.m.

HALTON BRANCH

Monday, 12th March 1951—Aircraft Icing Problems, Corporal Apprentice F. L. Maitland-Titterton and Corporal Apprentice E. Davies.

Monday, 19th March 1951—Brains Trust.
At Branch Headquarters, Halton, at 6.45 p.m., unless otherwise stated.

ISLE OF WIGHT BRANCH

Thursday, 8th March 1951—Methods of Time Keeping, Dr. R. d'E. Atkinson.

Thursday, 22nd March 1951—Junior Branch Prize Lecture.
In the Saunders-Roe Sports and Social Club, at 6 p.m.

LEICESTER BRANCH

Friday, 13th April 1951—Rockets and Space Travel, J. Humphries, B.Sc., A.M.I.Mech.E., A.F.R.Ae.S.
In Room 104, College of Technology, The Newarkes, Leicester, at 7.15 p.m.

LUTON BRANCH

Wednesday, 2nd May 1951—Plastics in Aircraft, J. Byers.

Wednesday, 23rd May 1951—Film Show and Discussion Evening.
At the George Hotel, Luton, at 7.30 p.m.

MANCHESTER BRANCH

Thursday, 29th March 1951—Cabin Air Conditioning, W. M. Widgery, F.R.Ae.S.
In the Reynolds Hall, College of Technology, Manchester, at 7.30 p.m.

PRESTON BRANCH

Wednesday, 28th March 1951—Lecturettes.

Wednesday, 25th April 1951—Annual General Meeting.
In the Assembly Hall, Technical College, Corporation Street, Preston, at 7.30 p.m.

PORTSMOUTH BRANCH—FILM PROGRAMME

Thursday, 15th March 1951—Casting and Forging Light Alloys (High Duty Alloys).

Thursday, 29th March 1951—Annual General Meeting.
At the Apprentices' School, Airspeed Ltd., The Airport, Portsmouth, at 6 p.m.

SOUTHAMPTON BRANCH

Wednesday, 21st March 1951—The Further Development of the Brabazon Type, G. P. Hebden, B.Sc., A.F.R.Ae.S.

Wednesday, 11th April 1951—Instrumentation for Testing Aircraft and Aero-Engines, C. N. Jaques, B.Sc., A.F.R.Ae.S. (Joint meeting with Southern Branches of Institution of Mechanical Engineers and Institution of Electrical Engineers).
In the Physics Lecture Theatre, University College, at 7 p.m.

WEYBRIDGE BRANCH

Wednesday, 14th March 1951—Turbine-Engined Aircraft, G. R. Edwards, M.B.E., B.Sc., F.R.Ae.S., A.M.I.Struct.E.

Wednesday, 4th April 1951—Gas Turbines, S. G. Hooker, O.B.E., A.R.C.Sc., B.Sc., D.I.C., D.Phil., F.R.Ae.S., F.R.S.A.
Wednesday, 18th April 1951—Junior Prize Lecture, Branch Members.
Wednesday, 2nd May 1951—Annual General Meeting and Smoking Concert. At Vickers-Armstrongs Ltd., Weybridge, at 6 p.m.

ASSOCIATE FELLOWSHIP EXAMINATION RESULTS—DECEMBER 1950

The following were successful in the Associate Fellowship Examination (New Syllabus) held in December 1950:—

PART I

H. A. Buchholdt, Applied Mathematics, Properties of Matter, Heat, Light and Sound, Theory of Machines.

D. W. Cocking, Applied Mathematics, Properties of Matter, Heat, Light and Sound, Theory of Machines.

R. S. Dabbs, Applied Mathematics, Properties of Matter, Heat, Light and Sound, Strength of Aircraft Materials and Theory of Structures I, Theory of Machines; D. A. Drane, Applied Mathematics, Properties of Matter, Heat, Light and Sound, Strength of Aircraft Materials and Theory of Structures I, Theory of Machines.

G. H. Fenton, Properties of Matter, Heat, Light and Sound; V. N. Ferriman, Pure Mathematics, Magnetism, Electricity and Electronics, Strength of Aircraft Materials and Theory of Structures I.

D. R. Henbest, Applied Mathematics, Strength of Aircraft Materials and Theory of Structures I, Theory of Machines; R. L. Holmes, Applied Mathematics, Properties of Matter, Heat, Light and Sound, Aerodynamics I, Theory of Machines.

E. Mowforth, Applied Mathematics, Properties of Matter, Heat, Light and Sound, Strength of Aircraft Materials and Theory of Structures I, Theory of Machines; C. L. Munro, Applied Mathematics, Strength of Aircraft Materials and Theory of Structures I, Theory of Machines.

W. A. Page, Applied Mathematics, Magnetism, Electricity and Electronics, Theory of Prime Movers and Fuels; G. S. Pool, Aerodynamics I.

C. R. Raynham, Applied Mathematics, Properties of Matter, Heat, Light and Sound, Strength of Aircraft Materials and Theory of Structures I, Theory of Machines.

B. Shergill, Applied Mathematics, Properties of Matter, Heat, Light and Sound, Strength of Aircraft Materials and Theory of Structures I, Theory of Machines; I. H. Smart, Applied Mathematics, Properties of Matter, Heat, Light and Sound, Strength of Aircraft Materials and Theory of Structures I, Theory of Machines.

K. Thein, Strength of Aircraft Materials and Theory of Structures I.

F. I. V. Walker, Applied Mathematics, Properties of Matter, Heat, Light and Sound, Strength of Aircraft Materials and Theory of Structures I, Theory of Machines.

ABROAD

A. F. El-Kerdani, Properties of Matter, Heat, Light and Sound.

Krishna Iyer, Applied Mathematics, Strength of Aircraft Materials and Theory of Structures I, Theory of Prime Movers and Fuels.

PART II

B. M. Laven, Aerodynamics II.

ANNUAL SUBSCRIPTIONS

Members are reminded that their annual subscriptions became due on 1st January 1951. The rates are:—

	HOME	ABROAD
	£ s. d.	£ s. d.
Fellows	5 5 0	4 4 0
Associate Fellows	4 4 0	3 3 0

*Associates	3 3 0	3 3 0
Graduates (aged under 26) ...	2 2 0	2 2 0
Graduates (aged 26 and over) ...	2 12 6	2 12 6
Students (aged under 21) ...	1 1 0	1 1 0
Students (aged 21 and over) ...	1 11 6	1 11 6
Companions	3 3 0	3 3 0
Founder Members	2 2 0	2 2 0

* Any Associate elected before 1st October 1947 may, if he wishes, elect not to receive the JOURNAL, and in this case his subscription will be reduced by £1 1s. 0d. to £2 2s. 0d.

It will avoid delay and confusion if members, when sending remittances for subscriptions, will state their names clearly and give their addresses and grades of membership.

Remittances should be made payable to the Royal Aeronautical Society.

ELECTIONS

The following is a list of new members and transfers of membership of the Society:—

Associate Fellows

Stanley Thomas Alvey, Kenneth Nairn Beatts (from Graduate), Walter Gordon Bradfield (from Graduate), Ronald Peart Cauthery, Kenneth Sydney Robert Child (from Graduate), William Stevenson Cunningham (from Graduate), John Derek Davis (from Student), John Reginald Gardiner (from Associate), Kenneth William Kimber (from Graduate), Herbert Richard Leather (from Graduate), Cecil James Olaf Moorhouse (from Graduate), Alfred Webb Lindley, Maxwell Edmund Massy Perkins, Douglas Edgar Sidders, Robert Henry Warde.

Associates

John Bezzant, Frederick Walter Brightwell, Walter Alfred Bunce, Thomas George Evans, Edward Henry Holder, Brian Peter Hough, David Johnson, Harold Douglas Judkins, Frederick Alfred Laker, John Laver, Bernard John Stephens, Stanley Williams, Ronald James Wybrow.

Graduates

Richard Francis Beresford (from Student), David Brown (from Student), Peter John Chance (from Student), John James Cripps, Edmundo Gomes Ferreira Da Silva (from Student), Roy William Edwards, Frank Gowens, Brian John Griffin (from Student), Edwin Mosey Harris (from Student), David Hobson Hughes, Abraham Mendel Geoffrey Olsen (from Student), Ralph Parker, Robert Charles Pennicott (from Student), Denis John Powell (from Student), Gordon Reynard, Ronald Lion Samuels (from Student), David Kenshett Saunders (from Student), David Shellard (from Student), Phillip Reginald Simons, I. Elefterios Vezyrianidis, Robert Charles Wallin (from Student), Charles Ronald John Whitfield, Ivan Ray Yates.

Students

Malcolm Hesketh Barratt, Nigel Kenneth Benson, Ian Kendrick Blaen, Harry Bonney, David Philip Bowker, David John Bown, Peter Cambridge, Thomas Leon Dalzell, Victor Cecil Doggrell, Clive Ayrton Fleming, Sydney Oliver Frith, Allan Stuart Gilfile, John Harris, Arthur Thomas Hills, Harold Melville Kent, Surinder Bahadur Mathur, Ian Douglas Neilson, John Eric Nelson, Peter Chukuyenum Fielding Obi, Peter Robert Stokes, Derek Wardle Pickston, Anthony Willis, Garnet Wojna, Ernest Martin Woodhams.

JOURNAL BINDING

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CHANGES OF ADDRESS

To assist in keeping the records of members correct and up to date the Secretary will be glad if all members will notify him as soon as possible of changes of address.

When notifying changes please give the following particulars:—

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Changes of address must be received *before the 15th of the month* in order to be effective for the Journal for the following month.

ACKNOWLEDGMENTS

The Council acknowledge with grateful thanks the return of back numbers of the Journal from T. H. Turner, Esq., *Associate*; F. Holoubek, Esq., *Assoc. Fellow*; S. P. Prauss, Esq., *Assoc. Fellow*; and Dr. K. G. Bergin, *Assoc. Fellow*.

ADDITIONS TO THE LIBRARY

The following have been added to the Library (titles of pamphlets are printed in italics. Books marked * or ** may not be taken out on loan):—

Bartlett, Sir F. & H. N. Mackworth	Planned Seeing (A.P.3139B). H.M.S.O. (Air Ministry). 1950.
Haus, F.	Etude théorique du pilotage automatique des avions. Soc. Royale Belge des Ing. et des Ind. 1950.
Knight, R. A. G.	Requirements and Properties of Adhesives for Wood (Forest Products Research Bulletin No. 20). H.M.S.O. (D.S.I.R.). 1950.
Kuethe, A. M. & J. D. Schetzer	Foundations of Aerodynamics. Wiley (Chapman and Hall). 1950.
Pollitt, C. A. H.	Air Systems for Aircraft. Pitman. 1950.
Rambo, W. R., *et al.*	Final Report on Evaluation of Omni-Bearing-Distance System of Air Navigation. 2 volumes. Airborne Instruments Lab., Mineola, N.Y. 1950.

A.R.C. Current Papers.

27—*Stability tests on a large scale model of the Shetland hull bottom. H. G. White and A. G. Smith.*

28—*Camber derivatives and two-dimensional tunnel interference at maximum lift. R. C. Pankhurst and H. H. Pearcey.*

29—*The low speed performance of related aerofoils in cascades. A. D. S. Carter.*

31—*Some improvements in the design of thick suction aerofoils. J. Williams.*

32—*Air bags as flexible supports in ground resonance testing of aircraft. R. L. Moffat and D. R. Gaukroger.*

34—*Torsional vibration investigations on the Musketeer engine. E. Downham, Winifred Davidson and M. O. Wolfe.*

A.R.C. Reports and Memoranda

2391—*The determination of the fixed root frequencies of propeller blades using scale models and the results compared with calculations. G. A. Luck and Miss W. Lowes.*

2398—*A suggested method of increasing the damping of aircraft structures. D. H. D. Cooper.*

2434—*The effect of flange stiffness on the stresses in a plate web spar under shear. D. M. A. Leggett and H. G. Hopkins.*

2439—*Note on wing-nacelle-airscrew interference. E. Ower, R. Warden and R. C. Pankhurst.*

2452—*Wind tunnel tests on lateral control with high-lift flaps made on the S.24/37. R. Hills, R. E. W. Harland and R. H. Whitby.*

2477—*Measurement of thrust and torque grading on high-pitch model airscrews. C. N. H. Lock, H. Bateman and H. L. Nixon.*

2491—*Flight tests on a Falcon with spoiler lateral control. C. E. Kerr.*

2569—*Spar depth and weight. W. Tye and R. G. Thorne.*

Aeronautical Research Laboratories, Australia. Report.

A.72—*The measurement of the Reynolds stresses in a circular pipe as means of testing a hot wire anemometer. B. G. Newman and B. G. Leary.*

Ministère de l'air. France. Publications scientifiques et techniques.

238 *Nouvelles recherches sur la sommation pratique des séries divergentes: aperçus théoriques nouveaux. P. Vernotte.*

244—*L'allumage électrostatique des moteurs a explosion. M. Point.*

245—*Etude et réalisation d'un équipement électronique pour la mesure et l'enregistrement de faibles variations de capacité: application aux mesures aérodynamiques et hydrodynamiques. P. Sauvage.*

Nationaal Luchtvaartlaboratorium. Holland. Report in English.

S.368—*A "solid-guide fixture" for determining the properties of thin sheet material in compression. J. H. Rondeel and G. C. Duyn.*

Civil Aeronautics Administration, U.S.A., Technical Development Report.

116—*The development of techniques for the utilization of VHF radio in light aircraft. F. Gehres, E. C. Gregory and James O. Martin.*

***National Advisory Committee for Aeronautics, U.S.A. Technical Notes.**

2136—*Theory of helicopter damping in pitch or roll and a comparison with flight measurements. K. B. Amer.*

2189—*The development and performance of two small tunnels capable of intermittent operation at Mach numbers between 0.4 and 4.0. W. F. Lindsey and W. L. Chew.*

2191—*Theoretical investigation and application of transonic similarity law for two dimensional flow. W. Perl and M. M. Klein.*

2193—*Effect of heat-capacity lag on a variety of turbine-nozzle flow processes. R. B. Spooner.*

2194—*The NACA oil-damped V-G recorder. I. Taback.*

2195—*A flight investigation and analysis of the lateral-oscillation characteristics of an airplane. C. J. Stough and W. M. Kauffman.*

2196—*Effect of heat-capacity lag on the flow through oblique shock waves. H. R. Ivey and C. W. Cline.*

2197—*Pressure distribution and damping in steady pitch at supersonic Mach numbers of flat swept-back wings having all edges subsonic. H. J. Walker and Mary B. Ballantyne.*

2198—*Sintering mechanism between zirconium carbide and columbium. H. J. Hamjian and W. G. Lidman.*

2199—*Wind-tunnel investigation at low speed of the lateral control characteristics of an unswept untapered semispan wing of aspect ratio 3.13 equipped with various 25-per cent.-chord plain ailerons. H. S. Johnson and J. R. Hagerman.*

2201—*Measurement of the moments of inertia of an airplane by a simplified method. H. L. Turner.*

2202—*Effect of heat and power extraction on turbojet-engine performance: III—analytical determination of effects of shaft-power extraction. S. L. Koutz, R. V. Hensley and F. E. Rom.*

2203—*Boundary-layer measurements in 3.84 by 10-inch supersonic channel P. F. Brinich.*

2204—*Gust-tunnel investigation of a wing model with semichord line swept back 60°. H. B. Pierce.*

2205—*Theoretical supersonic characteristics of inboard trailing-edge flaps having arbitrary sweep and taper Mach lines behind flap leading and trailing edges. J. H. Kainer and J. E. Marte.*

2206—*Graphical method for obtaining flow field in two-dimensional supersonic stream to which heat is added. I. I. Pinkel and J. S. Serafini.*

2207—*Analysis of turbulent free-convection boundary layer on flat plate. E. R. G. Eckert and T. W. Jackson.*

2208—*Analysis of shear strength of honeycomb cores for sandwich constructions. F. Werren and C. B. Norris.*

2209—*Free oscillations of an atmosphere in which temperature increases linearly with height. C. L. Pekeris.*

2210—*Impact-pressure interpretation in a rarefied gas at supersonic speeds. E. D. Kane and G. J. Maslach.*

2211—*An approximate method of calculating pressures in the tip region of a rectangular wing of circular-arc section at supersonic speeds. K. R. Czarnecki and J. N. Mueller.*

2212—*The effect of ice formations on propeller performance. C. B. Neel and L. G. Bright.*

2213—*Aerodynamic coefficients for an oscillating airfoil with hinged flap, with tables for a Mach number of 0.7. M. J. Turner and S. Rabinowitz.*

2214—*Formulas and tables of coefficients for numerical differentiation with function values given at unequally spaced points and application to solution of partial differential equations. Chung-Hua Wu.*

2219—*The dynamic lateral control characteristics of airplane models having unswept wings with round- and sharp-leading-edge sections. J. L. Hassell and C. V. Bennett.*

2220—*A balsa-dust technique for air-flow visualization and its application to flow through model helicopter rotors in static thrust. Marion K. Taylor.*

2221—*Equations and charts for the rapid estimation of hinge-moment and effectiveness parameters for trailing-edge controls having leading and trailing edges swept ahead of the Mach lines. K. L. Goin.*

J. LAURENCE PRITCHARD,

Secretary,

THE ROYAL AERONAUTICAL SOCIETY

4 Hamilton Place, Piccadilly, London, W.1. Tel.: Grosvenor 3515-19

Made and printed in Great Britain by The Lewes Press, Friars Walk, Lewes, Sx.

SECRETARY'S NEWS LETTER

FOR APRIL 1951

ANNUAL GENERAL MEETING, 10th MAY 1951

Notice is hereby given that the Annual General Meeting of the Royal Aeronautical Society, with which is incorporated the Institution of Aeronautical Engineers, will be held on Thursday 10th May 1951 at 6 p.m., in the offices of the Society, 4 Hamilton Place, London, W.1.

AGENDA

1. To read the Notice convening the Meeting.
2. To receive and deliberate upon the Report of the Council on the state of the Society and the Balance Sheets and Income and Expenditure Accounts of The Royal Aeronautical Society and Aeronautical Trusts Limited for the year ended 31st December 1950.
3. To receive the names of those elected to Council for the years 1951-54.
4. To announce the names of Fellows elected by the Council in accordance with By-Law 4.
5. To elect the Auditors for the year 1951.
6. Any other business.

By Order of the Council,

J. LAURENCE PRITCHARD,

Secretary.

2nd April 1951.

Note.—In accordance with the By-Laws any member whose subscription has not been paid before the first day of April is not entitled to vote.

Light refreshments will be served after the meeting.

PRESIDENT 1951-52

Major F. B. Halford, C.B.E., *Fellow*, has been elected President of the Society for 1951-52. The President takes office at the Annual General Meeting.

GARDEN PARTY, 6th MAY 1951

The Society's Annual Garden Party will be held on Sunday 6th May 1951 at White Waltham Aerodrome, near Maidenhead, by kind permission of the Ministry of Supply and the Fairey Aviation Co. Ltd. An application form is enclosed with this JOURNAL to home members.

As usual attractive flying and printed programmes are being prepared. This is the first flying party of the Festival year and provides an opportunity for members to meet their friends.

THIRD ANGLO-AMERICAN AERONAUTICAL CONFERENCE

A leaflet containing particulars of the preliminary arrangements for the Third Anglo-American Aeronautical Conference, which is to be held at Brighton from 3rd-7th September 1951, was enclosed with the March JOURNAL. With the leaflet was an application form for enrolment, which members are asked to complete when making their application.

CONTENTS OF THE APRIL JOURNAL

Clear Air Turbulence Over Europe, G. S. Hislop, Ph.D., B.Sc., A.R.T.C., A.F.R.Ae.S., M.I.Mech.E.

Measurement of Jet Engine Thrust, Bengt Jakobsson, Dr.Sc.(Eng.), A.F.R.Ae.S.

86th Annual Report of the Council.

Reviews.

Correspondence.

The Council are particularly anxious to encourage members of the Society to support their own Journal by contributions to it of articles and papers on any aspect of Aeronautics. For that purpose they have set aside £250 a year in the form of premium awards to the authors (members or non-members) of such papers as some reimbursement for the work which has been done by the author. These premium awards are not fixed but vary from five to twenty guineas normally. It is hoped therefore that those members who have written papers on their special subjects will consider their own Journal in the first place.

THE AERONAUTICAL QUARTERLY, VOLUME II, PART IV

Part IV, Volume II of "The Aeronautical Quarterly" is available from the offices of the Society at 7s. 9d. a copy to members of the Society, post-paid, or 10s. 3d. to non-members, post-paid.

The Contents of Part IV are:—

Supersonic Flow Investigations with a "Hydraulic Analogy" Water Channel	Joseph Black and O. P. Mediratta
Contracting Ducts of Finite Length	L. G. Whitehead, L. Y. Wu and M. H. L. Waters
The Properties of Crossed Flexure Pivots and the Influence of the Point at which the strips cross	W. H. Wittrick
An Analysis of the Lift on Straight, Yawed and Swept-back Wings	J. Lockwood Taylor
Index to Volume II.	

Copies of the rest of Volume II, Parts I, II and III and a few copies of Volume I, Parts I to IV are still available, but members are reminded that a strictly limited edition only of "The Aeronautical Quarterly" is printed and numbers cannot be reprinted in any circumstances. An annual subscription to Volume III therefore is advisable.

MEMBERS' NEW APPOINTMENTS

W. M. Widgery (*Fellow*)—Director and Chief Engineer, Normalair Limited.

Commander F. W. N. Bassett (*Associate Fellow*)—Director and Commercial Manager, Normalair Limited.

P. E. Felgate (*Associate Fellow*)—Chief Development Engineer, Waymouth Gauges and Instruments Ltd.

H. A. Carless (*Associate Fellow*)—Structures Development Engineer, Chance Vought Aircraft, Dallas, Texas.

Captain J. H. H. Luxton (*Associate Fellow*)—Airport Manager, Walney Island Airport, Barrow-in-Furness.

Colonel H. L. W. Stevens (*Associate Fellow*)—Technical Expert in Baghdad, Iraqi State Railways, which own and run Iraqi Airways.

NEWS OF BRANCHES

The President visited the Manchester Branch on Wednesday 28th February 1951 when a Film Show was given to the members, and attended the Birmingham Branch Annual Dinner, accompanied by Mrs. Bulman, on Saturday 10th March. The President also attended a meeting of the newly formed Halton Branch on Monday 19th March, when a Brains Trust was arranged.

ASSOCIATE FELLOWSHIP EXAMINATION

The next Associate Fellowship Examination in the New Syllabus will be held in the offices of the Society on 29th, 30th and 31st May 1951. All candidates who have entered for the Examination will be informed individually of the detailed arrangements.

ELLIOTT MEMORIAL PRIZE

The Elliott Memorial Prize has been awarded to Aircraft Apprentice T. L. Cox, of the May 1948 Entry at R.A.F., Halton, who has obtained the highest marks in the General Studies Examination. The prize will be presented at the Graduation Prize Giving on the 8th May 1951.

CONGRÈS INTERNATIONAL DE GIRAVIATION

The attention of members is drawn to the Congrès International de Giraviation organised by the Association Française des Ingénieurs et Techniciens de l'Aéronautique and the Aero Club de France which will be held during the second fortnight in June 1951. Any members who wish to attend this Congress or who would like further particulars, should write to the Secretary-General at 6 Rue Cimarosa, Paris 16.

LECTURES—SPRING 1951

MAIN LECTURES

(At 6 p.m. in the Lecture Hall of the Institution of Civil Engineers, Great George Street, London, S.W.1, unless otherwise stated. Tea will be served at 5.30 p.m.)

Thursday, 12th April 1951—Planning and Production Methods as Applied to the Comet, H. Povey, A.F.R.Ae.S.

Thursday, 26th April 1951—A DISCUSSION. Air Travel from the Passenger's Point of View.

SECTION LECTURE

(At 7 p.m. in the Library of the Royal Aeronautical Society, 4 Hamilton Place, London, W.1, unless otherwise stated.)

Tuesday, 10th April 1951—Simulators, W. R. Thomas, B.Sc., A.M.I.E.E.

GRADUATES' AND STUDENTS' LECTURE

(At 7.30 p.m. in the Library of the Royal Aeronautical Society, 4 Hamilton Place, W.1, unless otherwise stated. Visitors are welcome to attend.)

Thursday, 19th April 1951—Boundary Layer Control, E. D. Poppleton, M.Sc.

BRANCH LECTURES AND NOTICES

Notices of Branch Lectures and Meetings for inclusion in the Monthly Notices of the Society must be received by the 20th of the preceding month. The Honorary Secretaries of all Branches are asked to inform the Society of their arrangements for meetings so that a complete list of Branch meetings may be given.

BIRMINGHAM BRANCH

Friday, 27th April 1951—Annual General Meeting. At the White Horse Hotel, Birmingham.

BRISTOL BRANCH

Tuesday, 17th April 1951—Some Notes on Overhaul and Maintenance, C. H. Jackson, B.Sc., A.C.G.I., A.F.R.Ae.S., A.M.I.Mech.E.

Monday, 30th April 1951—Annual General Meeting and Film Show.

In the Conference Room, Filton House, The Bristol Aeroplane Co. Ltd. at 6 p.m., unless otherwise stated.

COVENTRY BRANCH

Wednesday, 18th April 1951—Annual General Meeting and Films. In the Wine Lodge Hotel, The Burges, Coventry, at 7.30 p.m.

DERBY BRANCH

Monday, 7th May 1951—Long Range Turbo-Jet Transports, A. E. Russell, B.Sc., F.R.Ae.S.

In the Rolls-Royce Welfare Hall, Nightingale Road, Derby, at 6.15 p.m.

LEICESTER BRANCH

Friday, 13th April 1951—Rockets and Space Travel, J. Humphries, B.Sc., A.M.I.Mech.E., A.F.R.Ae.S.

In Room 104, College of Technology, The Newarkes, Leicester, at 7.15 p.m.

LUTON BRANCH

Wednesday, 2nd May 1951—Plastics in Aircraft, J. Byers.

Wednesday, 23rd May 1951—Film Show and Discussion Evening.

At the George Hotel, Luton, at 7.30 p.m.

PRESTON BRANCH

Wednesday, 25th April 1951—Annual General Meeting.

In the Assembly Hall, Technical College, Corporation Street, Preston, at 7.30 p.m.

SOUTHAMPTON BRANCH

Wednesday, 11th April 1951—Instrumentation for Testing Aircraft and Aero-Engines, C. N. Jaques, B.Sc., A.F.R.Ae.S. (Joint meeting with Southern Branches of Institution of Mechanical Engineers and Institution of Electrical Engineers).

In the Physics Lecture Theatre, University College, at 7 p.m.

WEYBRIDGE BRANCH

Wednesday, 18th April 1951—Junior Prize Lecture, Branch Members.

Wednesday, 2nd May 1951—Annual General Meeting and Smoking Concert.

At Vickers-Armstrongs Ltd., Weybridge, at 6 p.m.

PROFESSIONAL ENGINEERS FOR MINISTRY OF SUPPLY

The Civil Service Commissioners invite applications for permanent appointments of Professional Engineers (Higher Departmental Grades) in the Ministry of Supply. Applications will be accepted at any time before 30th June 1951, but a closing date for the receipt of applications earlier than 30th June 1951 may eventually be announced. Selected candidates will be interviewed as soon as possible after the receipt of their application forms. Candidates are advised to apply as early as possible.

Candidates must be at least 30 years of age on 1st January 1951.

Candidates must (1) be Corporate Members of one of the Institutions of Civil, Mechanical or Electrical Engineers, or Associate Fellows of the Royal Aeronautical Society, or (2) have served an engineering apprenticeship or pupilage including a minimum period of two years in the workshops of a reputable establishment, and either hold a University degree in Engineering, or a Higher National Certificate in mechanical or electrical engineering with the endorsements necessary to secure exemption from the whole of the Associate Membership examination of one of the above named professional Institutions, or have passed any other examinations recognised by one of the above named Institutions as granting exemption from the whole of its Associate Membership examination, or by the Royal Aeronautical Society as exempting from its Associate Fellowship examination.

Candidates will be required to undertake the more responsible duties in a wide variety of professional engineering work. Preference will be given to those candidates with experience in

(*a*) The design and construction of large factories and the necessary plant and services,

(*b*) The design of radio and radar equipment,

(*c*) The design and development of very high precision medium and light mechanical devices,

(*d*) The production of aircraft engines or electric cables.

(*e*) The installation and maintenance of plant, gas, electrical water and steam services in large factories,

(*f*) Production management in a large factory filling ammunition.

In some cases houses will be available at moderate rents for successful candidates. London salary scales:—

	Men	*Women*
Main Grade	£750 — £1,000	£650 — £850
Senior Grade	£1,050 — £1,270	£900 — £1,100

Further particulars and application forms are obtainable from the Civil Service Commission, Scientific Branch, Trinidad House, Old Burlington Street, London, W.1, quoting No. S87/51. Completed application forms should be returned as soon as possible.

ELECTIONS

The following is a list of new members and transfers of membership of the Society:—

Associate Fellows

Eric Aubrey (from Graduate), Norman Frederick George Banfield (from Graduate), Brian Stewart Eamer Beattie (from Graduate), John William Davison, Peter Edward Felgate, Stefan Alexander Grott, Keith Leonard Charles Legg (from Student), William Maurice Locke (from Graduate), Ian Robert Lyon (from

Graduate), Maitland Robert Roper (from Associate), Theo Vincent Small (from Graduate), Sydney Snell (from Graduate), Harold Geoffrey Spurr, Robert Walter Wilson Tennant (from Graduate), Albert William Watkins.

Associates

Richard Frederick John Brock, Basil Benedict Fleming, Lawrence Gray, Gwyn Griffiths, Reginald Hugh Howard, Albert Madoc Lovatt, Frank Henry Roberts, Geoffrey Musgrave Shipway, Sidney Harold Phillip Smith, Ronald John Reynolds Steer, Harold Townley, Ernest Brian Trubshaw, Gordon Arthur Vickers, Harold James Watts.

Graduates

Ronald Desmond Anthony (from Student), Alan Edgar Bingham, Victor Rex Bunyard, John Alan Caister (from Student), Trevor Storr Davies (from Student), Paul Kichenside Digby, Ronald Edward Dudley, Robert Harold Ladd, Charles Henry Martin, George Beric Parkin, Harry Nigel Saint (from Student), Arthur Griffith Patrick Vaughan, Geoffrey Wass (from Student).

Students

Charles John Adey, Robert Colville Aikman, John Alfred Bones, Alexander Campbell Craighead, John Ernest Felstead, Thomas Henry Hallstaff, Raymond Alan Harrison, John Charles Michael Jones, John Barry Large, Harold Moore Lofthouse, Lawrence Pickering, David Arthur Sharp.

Companions

Yashvant Thakorelal Desai (from Graduate), John Valentine Amyard Haggard, Dennis Job Upton, George Frederick Watson.

INCOME TAX

In response to numerous inquiries from members with regard to a rebate on Income Tax for their subscriptions, the following is a copy of a letter received from the Principal Inspector of Taxes.

Ref. H.R.S. 34/C.I. 4420/63.

Dear Sir,

Further to your interview with Mr. Stonely at this office on the 19th July, I am now in a position to inform you that the Board of Inland Revenue will not raise objection to the allowance as an expense for Income Tax purposes of annual subscriptions paid by members who are:—

(*i*) Assessable under Schedule D of the Income Tax Acts in respect of professional or trading profits, subject to the decision of the Commissioners who make the assessment that such subscriptions are sufficiently closely related to the business on: or

(*ii*) Assessable under Schedule E in those cases only in which continual membership of the Society is an essential condition of the terms of appointment.

Yours faithfully,

(Signed) GEO. WILCOCK,

Principal Inspector of Taxes.

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Grade of membership.
New address (in block letters).
Old address.

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ADDITIONS TO THE LIBRARY

The following have been added to the Library (titles of pamphlets are printed in italics. Books marked * or ** may not be taken out on loan):—

Banks, F. R.	The Aviation Engine. I.Mech.E.(Preprint). 1951.
Barton, F. A.	Jack of All Trades. Bale Sons & Curnow. 1938.
Bolster, C. M.	The Assisted Take-Off of Aircraft. Norwich University (U.S.). 1950.
Kopal, Z. (*Director*)	Tables of Supersonic Flow Around Cones of Large Yaw. Massachusetts Inst. Technology. 1949.
Lipson, C., G. C. Noll and L. S. Clock	Stress and Strength of Manufactured Parts. McGraw Hill. 1950.
Schonland, B. F. J.	The Flight of Thunderbolts. O.U.P. 1950
Shawcross, C. N., K. M. Beaumont, etc.	Shawcross and Beaumont on Air Law. Second Edition. Butterworth. 1951.

A.R.C. Reports and Memoranda

2457—*Tests on thick cuff sections in the compressed air tunnel. D. H. Williams and A. F. Brown.*

College of Aeronautics, Cranfield. Reports

12—*Addendum.*
41—*Corrigendum.*
42—*The equations of motion and energy and the velocity profile of a turbulent boundary layer in a compressible fluid. A. D. Young.*

Aeronautical Research Laboratories, Australia. Reports

A.73—*Skin friction in a retarded turbulent boundary layer near separation. B. G. Newman.*
SM.160—*An experimental determination of the fatigue strength of CA-12 "Boomerang" wings. W. W. Johnstone, C. A. Patching and A. O. Payne.*
SM.162—*The approximate deflection of thin flat triangular plates subjected to uniform normal load. Part II. J. Guest and F. S. Shaw.*

Ministère de l'Air. France. Publications scientifiques et techniques

246—*Recherches sur la genèse de la turbulence dans les conduites en charge. R. Comolet.*

Max-Planck-Institut für Strömungsforschung. Göttingen. Mitteilungen

3—*Der Einflusz der wandnahen Strömung auf den turbulenten Wärmeübergang. H. Reichardt.*

National Advisory Committee for Aeronautics, U.S.A.
Reports

951—*Use of source distributions for evaluating theoretical aerodynamics of thin finite wings at supersonic speeds. J. C. Evvard.*

953—*Attainable circulation about airfoils in cascade. A. W. Goldstein and A. Mager.*

956—*Linearized compressible-flow theory for sonic flight speeds. M. A. Heaslet, H. Lomax and J. R. Spreiter.*

957—*The calculation of downwash behind supersonic wings with an application to triangular plan forms. H. Lomax, L. Sluder and M. A. Heaslet.*

961—*The application of Green's theorem to the solution of boundary-value problems in linearised supersonic wing theory. M. A. Heaslet and H. Lomax.*

962—*The aerodynamic forces on slender plane- and cruciform-wing and body combinations. J. R. Spreiter.*

***Technical Memoranda**

1246—*Hydrodynamic properties of planing surfaces and flying boats. N. A. Sokolov.*

1261—*On the theory of the propagation of detonation in gaseous systems. Y. B. Zeldovich.*

J. LAURENCE PRITCHARD,
Secretary,

THE ROYAL AERONAUTICAL SOCIETY
4 Hamilton Place, Piccadilly, London, W.1. Tel.: Grosvenor 3515-19

Made and printed in Great Britain by THE LEWES PRESS Friars Walk, Lewes, Sx.

SECRETARY'S NEWS LETTER

FOR MAY 1951

ANNUAL GENERAL MEETING

Voting members of the Society are reminded that the Annual General Meeting will be held on Thursday, 10th May 1951 at 6 p.m. in the offices of the Society. The formal Notice calling the meeting was published in the April News Letter.

WHITSUN HOLIDAYS

The Offices and Library of the Society will be closed from 5 p.m. on Friday, 11th May to 9 a.m. on Tuesday, 15th May 1951, for the Whitsun holidays.

CLOSING OF THE LIBRARY

The Library will be closed on Tuesday, Wednesday and Thursday, 29th, 30th and 31st May 1951 for the Associate Fellowship Examinations, which will be held there.

39th WILBUR WRIGHT MEMORIAL LECTURE—SPECIAL NOTICE

The 39th Wilbur Wright Memorial Lecture will be held at the *Royal Institution, 21 Albemarle Street, W.1*, on 10th September 1951 at 6 p.m., and *not* at The Institution of Civil Engineers. The lecture will be read by Mr. A. E. Raymond, of the Douglas Aircraft Corporation, and the title will be announced later.

SEVENTH BRITISH COMMONWEALTH AND EMPIRE LECTURE

The Seventh British Commonwealth and Empire Lecture will be held at the Institution of Civil Engineers, Great George Street, S.W.1, on 4th October 1951 at 6 p.m. The lecture will be read by Air Vice-Marshal Sir L. M. Isitt, of New Zealand, and the title will be announced later.

THIRD ANGLO-AMERICAN AERONAUTICAL CONFERENCE

A leaflet containing particulars of the arrangements for the Third Anglo-American Aeronautical Conference, which is to be held at Brighton from 3rd-7th September 1951, is enclosed with the May JOURNAL and this issue of the Secretary's News Letter. With the leaflet is an application form for enrolment, which members are asked to complete when making their application. Applications for enrolment should be returned as soon as possible.

GUILD OF AIR PILOTS AND AIR NAVIGATORS OF THE BRITISH EMPIRE

Mr. J. Lankester Parker, O.B.E., *Fellow*, was elected Master of the Guild of Air Pilots and Air Navigators on 12th April 1951.

CONTENTS OF THE MAY JOURNAL

Fourth Louis Bleriot Lecture—Power versus Weight in Aviation, Maurice Roy.
Boundary Layers and Skin Friction in High-Speed Flow, A. D. Young, M.A., A.F.R.Ae.S.
Planning and Aircraft Development, F. Olaf Thornton, A.F.R.Ae.S.

The Council are particularly anxious to encourage members of the Society to support their own Journal by contributions to it of articles and papers on any aspect of Aeronautics. For that purpose they have set aside £250 a year in the form of premium awards to the authors (members or non-members) of such papers as some reimbursement for the work which has been done by the author. These premium awards are not fixed but vary from five to twenty guineas normally. It is hoped therefore that those members who have written papers on their special subjects will consider their own Journal in the first place.

THE AERONAUTICAL QUARTERLY—VOLUME III, PART I

Volume III, Part I, of "The Aeronautical Quarterly" will be available from the offices of the Society towards the end of May at 7s. 9d. a copy to members of the Society, post-paid, or 10s. 3d. to non-members, post-paid.

The contents of Part I, Volume III, will be:—

The Symmetric Vibrations of Aircraft	R. W. Traill-Nash
Airscrews at Supersonic Forward Speeds	J. C. Burns
Polhausen's Method for Three - Dimensional Laminar Boundary Layers	J. C. Cooke
Supersonic Flow Past Bodies of Revolution with Thin Wings	P. M. Stocker

Copies of Volume II, Parts I to IV and a few copies of Volume I, Parts I to IV are still available, but members are reminded that a strictly limited edition only of "The Aeronautical Quarterly" is printed and numbers cannot be reprinted in any circumstances. An annual subscription to Volume III therefore is advisable.

MEMBERS' NEW APPOINTMENTS

C. J. Luby (*Associate Fellow*)—General Manager and Director, Canadian Steel Improvement Ltd., a newly formed subsidiary of Steel Improvement & Forge Co., Cleveland, Ohio, U.S.A.

J. R. Standring (*Fellow*)—Appointment with the Indian Government on the manufacture of aircraft, at the Hindustan Aircraft Ltd., Bangalore.

Wing Cdr. R. H. Stocken (*Fellow*)—Aviation Consultant to J. Stone & Co. (Charlton) Ltd.

A. F. Toe (*Associate Fellow*)—Plant Engineer to Messrs. Brillo Manufacturing Company of Great Britain Ltd.

CITY AND GUILDS INSTITUTE

Mr. S. Scott Hall, C.B., M.Sc., D.I.C., *Fellow*, has been awarded Fellowship of the City and Guilds Institute.

METEOROLOGY AND AVIATION

Members of the Society are invited to attend an Ordinary Meeting of the Royal Meteorological Society on Wednesday, 16th May 1951 at which a Presidential Address on "Meteorology and Aviation" will be given by Sir Robert Watson-Watt, C.B., F.R.S., *Fellow*. The meeting will be held in the Lecture Theatre of the Science Museum, Exhibition Road, S.W.7, at 5.30 p.m.

The Royal Meteorological Society has offered to set aside a number of seats for members of the Society. Any member wishing to attend this meeting should inform the Assistant Secretary, Royal Meteorological Society, 49 Cromwell Road, London, S.W.7. Telephone: Kensington 0730.

LUTON BRANCH

Wednesday, 23rd May 1951—Film Show and Discussion Evening.

At the George Hotel, Luton, at 7.30 p.m.

ELECTIONS

The following is a list of new members and transfers of membership of the Society:—

Associate Fellow

Victor Roy Gordon Smith (from Graduate).

Associates

Patrick Coyle, George Boi Ditchman.

Graduates

Ronald Arthur Berridge (from Student), Malcolm Keith Bowden (from Student), Edward Lewis Houghton (from Student), Framji Minochehr Soonawalla, Edward Wray (from Student).

Students

Healey Vandelow Allen, Ivan Jeffrey Goldberg, Kriti Kumar Mukerjee.

JOURNAL BINDING

The prices of binding of Journals are as follows:—

1950 Volume (including packing and postage), 16s. 0d.

Previous Volumes (including packing and postage), 18s. 0d.

Journals, with a note of the name and address of the sender, should be sent direct to The Lewes Press, Friars Walk, Lewes, Sussex, and the remittance to the Secretary at the offices of the Society.

Cases only for unbound 1950 Volumes are available, price 6s. 6d. each. Requests for cases, with remittances, should be sent to the Secretary at the offices of the Society.

CHANGES OF ADDRESS

To assist in keeping the records of members correct and up to date the Secretary will be glad if all members will notify him as soon as possible of changes of address.

When notifying changes please give the following particulars:—

Name (in block letters).
Grade of membership.
New address (in block letters).
Old address.

Changes of address must be received *before the 15th of the month* in order to be effective for the Journal for the following month.

ACKNOWLEDGMENTS

The Council acknowledge with grateful thanks the gift of the first and second volumes of the Advisory Committee for Aeronautics Reports from Group Captain A. J. Miley, O.B.E.; and a "Pilot's Calculator" from Shell-Mex & B.P. Ltd.

They also acknowledge with thanks the return of back numbers of the JOURNAL from John Adams, Esq. and S. P. P. Guy, Esq.,*ex-Student*.

AERODYNAMICISTS AND TECHNICAL ASSISTANTS

Aerodynamicists and Technical Assistants are wanted for the Research Division of The Fairey Aviation Company Ltd. at Heston, Middlesex. The posts carry a Pension Scheme and offer excellent opportunities for advancement.

Aerodynamicists should have an Honours' Degree in Mathematics, Physics or Aeronautical Engineering and experience in one or more of the following fields:—Aircraft Dynamic Stability, Supersonics and Compressible Aerodynamics.

Technical Assistants are required mainly for structural strength and related investigations. An engineering degree or good Higher National Certificate with at least three years' experience of aircraft stressing is essential. Some knowledge and experience of routine performance estimation is desirable.

Applications for these posts, quoting Reference RD/TD/A for Aerodynamicists and RD/TD/TA for Technical Assistants, and giving full details of age, experience and qualifications, should be made to the:—Personnel Manager, The Fairey Aviation Co. Ltd., Hayes, Middlesex.

ADDITIONS TO THE LIBRARY

The following have been added to the Library (titles of pamphlets are printed in italics. Books marked * or ** may not be taken out on loan):—

Air Navigation Development Board	Program. C.A.A. 1951.
American Mathematical Society	Elasticity (Symposium Volume 3). McGraw Hill. 1950.
*British Standards Institution	Aluminium and Aluminium Alloy Sections (B.S.1161). B.S.I. 1951.
*Camm, F. J. (Editor)	Newnes' Engineer's Reference Book 1951. Newnes. 1951.
De Seversky, A. P.	Air Power: Key to Survival. Simon & Schuster (N.Y.). 1950.
Froesch, C.	What is needed in Future Airline Transport (1950).
*Institution of Naval Architects	Transactions Volume 92, 1950.
Lang, H. R. (Editor)	Physics of Lubrication. Inst. of Physics. 1951.
Liptrot, R. N.	Convertible Aircraft. Helicopter Association. 1950.
Marsh, W. Lockwood	The A.B.C. of Flying. Pleiades Books. 1945.
*Ministry of Civil Aviation	The Commercial Pilot's Licence. (Flying Machines). MCAP 54. H.M.S.O. 1950.
*Ministry of Civil Aviation	Senior Commercial and Airline Transport Pilot's Licences. MCAP 55. H.M.S.O. 1950.
*Ministry of Civil Aviation	Landing and Take-Off of Aircraft in Bad Weather. H.M.S.O. 1951.
*Ministry of Civil Aviation	First Report, Interdepartmental Helicopter Committee. H.M.S.O. 1951.

A.R.C. Reports and Memoranda

2390—*Analysis of strain gauge measurements on Barracuda rear fuselage—arrested landing loading condition. D. C. Allen.*

2418—*The effect of tab mass-balance on flutter. Part I, G. H. L. Buxton and G. D. Sharpe. Part II, C. Scruton, P. M. Ray and Miss D. V. Dunsdon.*

2429—*A note on the tensile strength and elongation of wide plates of aluminium alloy with and without holes. H. E. Smith and H. L. Cox.*
2435—*The design of fans and guide vanes for high-speed wind tunnels. W. A. Mair.*
2451—*Wind tunnel tests on the Supermarine S.24/37, a high-wing monoplane with a variable-incidence wing. H. Davies, J. E. Adamson and J. Seddon.*
2453—*Wind-tunnel tests on the experimental high lift M.18. R. Hills, E. C. Brown, M. A. Morrison and R. V. Becker.*
2459—*Experiments on two Piercy aerofoils in the compressed air tunnel. D. H. Williams, A. H. Bell and W. G. Raymer.*
2523—*Wind-tunnel experiments on the squidding of parachutes. L. F. G. Simmons, R. W. F. Gould and C. F. Cowdrey.*
2527—*The effect of model size on measurements in the R.A.E. high speed tunnel. Drag of two-dimensional symmetrical aerofoils at zero incidence. W. A. Mair and H. E. Gamble.*
2534—*Note on wind-tunnel measurements of yawing moment, rudder fixed and free, on models of three aircraft. J. E. Adamson, E. C. Brown and R. H. Allen.*
2544—*The induced drag of flapped elliptic wings with cut-out and with flaps that extend the local chord. A. D. Young.*
2545—*Note on the lift and profile drag effects of split and slotted flaps. A. D. Young and P. A. Hufton.*
2547—*Flight tests of a Youngman flap on Fairey P.4/34. K.7555. M. B. Morgan and D. E. Morris.*
2551—*Graphical treatment of binary mass-balancing problems. R. A. Frazer.*
2561—*Propeller blade vibration: nature and severity of vibration at edgewise resonance as influenced by coupling effects due to blade twist. J. F. Shannon and J. R. Forshaw.*
2571—*Wind tunnel tests on the Shetland. C. H. E. Warren and R. E. W. Harland.*
2578—*The case for factors of safety of 1.5 instead of 2.0 with special reference to the flight envelopes. P. E. Montagnon.*
2599—*Free-flight tests on kites in the 24-ft. wind tunnel. S. B. Jackson.*
2606—*Flutter of control surface tabs. G. A. Naylor.*

Aeronautical Research Laboratories, Australia. Reports

A.74—*Rapid approximate methods of solution to the equations of motion for a steady turn. J. R. Baxter.*
SM.147—*The effect of surface finish on the fatigue resistance of 24 S-T aluminium alloy. J. Y. Mann.*
Aerodynamics Note 99—*The skew hinge control mechanism with design charts. J. R. Baxter.*

National Research Council, Canada. Aeronautical Reports

AR-7—*Wall interference in wind tunnels of closed rectangular section. J. Sanders and J. R. Pounder.*

Nationaal Luchtvaartlaboratorium, Holland. Reports in English

F.41—*Theory of the oscillating aerofoil in two-dimensional incompressible flow (in 2 Parts). J. H. Greidanus and A. van Heemert.*
F.46—*Asymptotic formulae for special solutions of the hodograph equation in compressible flow. R. Timman.*
F.51—*The calculation of downwash fields for a lifting plane in steady flow. A. van Heemert.*
F.52—*Binary aileron tab flutter. A. I. van de Vooren and D. J. Hofsommer.*
F.58—*The calculation of the downwash at the surface of a lifting plane in steady flow. Tables, graphs and some simple checks. Part I, Theory. Part II, Tables and Graphs. A. van Heemert.*

National Advisory Committee for Aeronautics, U.S.A.

***Technical Memoranda**

1288—*The diffusion of a hot air jet in air in motion. W. Szablewski.*
1292—*Laws of flow in rough pipes. J. Nikuradse.*

***Technical Notes**

2200—*A study of second-order supersonic-flow theory. M. D. Van Dyke.*
2215—*Compressibility correction for turning angles of axial-flow inlet guide vanes. S. Lieblein and D. M. Sandercock.*
2216—*Investigation of 75-millimeter-bore cylindrical roller bearings at high speeds. II, Lubrication studies—effect of oil inlet location, angle, and velocity for single-jet lubrication. E. F. Macks and Z. N. Nemeth.*
2217—*Analysis of plane-stress problems with axial symmetry in strain-hardening range. M. H. Lee Wu.*
2218—*Diffusion of chromium in α cobalt-chromium solid solutions. J. W. Weeton.*
2223—*Investigation of the flow through a single-stage two-dimensional nozzle in the Langley 11-inch hypersonic tunnel. C. H. McLellan, T. W. Williams, and I. E. Beckwith.*
2224—*Multiple-film back-reflection camera for atomic strain studies. A. B. Marmo.*
2225—*Bending and buckling of rectangular sandwich plates. N. J. Hoff.*
2226—*Theoretical analysis of oscillations in hovering of helicopter blades with inclined and offset flapping and lagging hinge axes. M. Morduchow and F. G. Hinchey.*
2227—*Relation between inflammables and ignition sources in aircraft environments. W. E. Scull.*
2228—*Effects of modifications to the leading-edge region on the stalling characteristics of the NACA 63_1-012 airfoil section. J. A. Kelly.*
2229—*The effect of end plates on swept wings at low speed. J. M. Riebe and J. M. Watson.*
2230—*Synthesis and purification of alkyldiphenylmethane hydrocarbons I—2-methyldiphenylmethane, 3-methyldiphenylmethane and 4-isopropyldiphenymethane. J. H. Lamneck, Jr., and P. H. Wise.*
2231—*Comparison of fatigue strengths of bare and alclad 24S-T3 aluminum-alloy sheet specimens tested at 12 and 1,000 cycles per minute. F. C. Smith, W. C. Brueggeman and R. H. Harwell.*
2232—*Stress and distortion analysis of a swept box beam having bulkheads perpendicular to the spars. R. R. Heldenfels, G. W. Zender and C. Libove.*
2233—*Some effects of nonlinear variation in the directional-stability and damping-in-yawing derivatives on the lateral stability of an airplane. L. Sternfield.*
2234—*Statistical explanation of spontaneous freezing of water droplets. J. Levine.*
2235—*The boundary-layer and stalling characteristics of the NACA 64A010 airfoil section. R. F. Peterson.*
2236—*Supersonic flow around circular cones at angles of attack. A. Ferri.*
2237—*Correlations of heat-transfer data and of friction data for interrupted plane fins staggered in successive rows. S. V. Manson.*
2239—*Theoretical investigation of transonic similarity for bodies of revolution. W. Perl and M. M. Klein.*
2240—*The effect of nonuniform temperature distributions on the stresses and distortions of stiffened-shell structures. R. R. Heldenfels.*
2241—*A numerical method for the stress analysis of stiffened-shell structure under nonuniform temperature distributions. R. R. Heldenfels.*
2242—*Analytical investigation of turbulent flow in smooth tubes with heat transfer with variable fluid properties for Prandtl number of 1. R. G. Deissler.*
2243—*Effect of cell shape on compressive strength of hexagonal honeycomb structures. L. A. Ringelsteeter, A. W. Voss and C. B. Norris.*

2244—*A comparison of theory and experiment for high-speed free-molecule flow. J. R. Stalder, G. Goodwin and M. O. Creager.*

2245—*Calculation of compressible potential flow past slender bodies of revolution by an integral method. M. M. Klein and W. Perl.*

2246—*Method for determining distribution of luminous emitters in cone of laminar bunsen flame. T. P. Clark.*

2247—*A comparison of the lateral controllability with flap and plug ailerons on a sweptback-wing model having full-span flaps. P. M. Lovell, Jr.*

2248—*Analysis of the effects of design pressure ratio per stage and off-design efficiency on the operating range of multistage axial-flow compressors. M. Savage and W. R. Westphal.*

2249—*The spanwise distribution of lift for minimum induced drag of wings having a given lift and a given bending moment. R. T. Jones.*

2250—*An analysis of the applicability of the hypersonic similarity law to the study of flow about bodies of revolution at zero angle of attack. D. M. Ehret, V. J. Rossow and V. I. Stevens.*

2251—*Effects of Mach number up to 0.34 and Reynolds number up to* 8×10^6 *on the maximum lift coefficient of a wing of NACA 66-series airfoil sections. G. C. Furlong and J. E. Fitzpatrick.*

2252—*Formulas for source, doublet, and vortex distributions in supersonic wing theory. H. Lomax, M. A. Heaslet and F. B. Fuller.*

2253—*On a source-sink method for the solution of the Prandtl-Busemann iteration equations in two-dimensional compressible flow. K. C. Harder and E. B. Klunker.*

2254—*Regenerator-design study and its application to turbine-propeller engines. S. V. Manson.*

2255—*Two-dimensional compressible flow in centrifugal compressors with logarithmic-spiral blades. G. O. Ellis and J. D. Stanitz.*

2256—*Three-dimensional, unsteady-lift problems in high-speed flight: basic concepts. H. Lomax, M. A. Heaslet and F. B. Fuller.*

2257—*Temperature distribution in internally heated walls of heat exchangers composed on noncircular flow passages. E. R. G. Eckert and G. M. Low.*

2258—*Synthesis of cyclopropane hydrocarbons from methylcyclopropyl ketone. I: 2-cyclopropylpropene and 2-cyclopropylpropane. V. A. Slabey and P. H. Wise.*

2259—*Synthesis of cyclopropane hydrocarbons from methylcyclopropyl ketone. II: 2-cyclopropyl-l-pentene, cis and trans 2-cyclo-propyl-2-pentene and 2-cyclopropylpentane. V. A. Slabey and P. H. Wise.*

2260—*Synthesis and purification of some alkylbiphenyls and alkylbicyclohexyls. I. A. Goodman and P. H. Wise.*

2261—*Wind-tunnel investigation of a number of total-pressure tubes at high angles of attack: supersonic speeds. W. Gracey, D. E. Coletti and W. R. Russell.*

2262—*Rolling and yawing moments for swept-back wings in sideslips at supersonic speeds. S. Lampert.*

2263—*The use of a luminescent lacquer for the visual indication of boundary-layer transition. J. R. Stadler and E. G. Slack.*

2264—*Airfoil profiles for minimum pressure drag at supersonic velocities—general analysis with application to linearized supersonic flow. D. R. Chapman.*

2265—*NACA VGH recorder. N. R. Richardson.*

2267—*Inelastic column behaviour. J. E. Duberh and T. W. Wilder, III.*

2268—*Tests of two-blade propellers in the Langley 8-foot high-speed tunnel to determine the effect on propeller performance of a modification of inboard pitch distribution. J. B. Delano and M. M. Carmel.*

2269—*A structural-efficiency evaluation of titanium at normal and elevated temperatures. G. J. Heimerl and P. F. Barrett.*

2270—*Theoretical damping in roll and rolling effectiveness of slender cruciform wings. G. J. Adams.*

2271—*Further study of metal transfer between sliding surfaces. J. T. Burwell and C. D. Strang.*
2272—*Lateral elastic instability of hat-section stringers under compressive load. S. Goodman.*
2273—*Similarity laws for transonic flow about wings of finite span. J. R. Spreiter.*
2274—*Extension of the theory of oscillating airfoils of finite span in subsonic compressible flow. E. Reissner.*
2275—*A survey of stability analysis techniques for automatically controlled aircraft. A. L. Jones and B. R. Briggs.*
2277—*Effects of compressibility on the performance of two full-scale helicopter rotors. P. J. Carpenter.*
2278—*Theoretical symmetric span loading due to flap deflection for wings of arbitrary plan form at subsonic speeds. J. De Young.*
2280—*A theoretical analysis of the effects of fuel motion on airplane dynamics. A. A. Schy.*

Report

958—*Laminar mixing of a compressible fluid. D. R. Chapman.*

J. LAURENCE PRITCHARD,
Secretary,

THE ROYAL AERONAUTICAL SOCIETY
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GRADUATES' AND STUDENTS' SECTION

May 1951

ANNUAL GENERAL MEETING AND FILM SHOW

THE ANNUAL GENERAL MEETING of the Section will be held on Thursday 17th May at 7.30 p.m. at the Offices of the Society, 4 Hamilton Place, W.1. The Agenda for this meeting will be:—

(1) To consider the report of the Committee on the Section's affairs during the year.

(2) To make recommendations to the Council on the names of the representatives of the Section to serve on the Committee for the following year.

(3) To discuss the future activities of the Section.

(4) To consider any other business connected with the affairs of the Section.

The Committee members chosen by the Section are elected by vote at the Annual Meeting from those members of the Section who have been properly proposed and seconded and who have signified their consent to serve on the Committee, if approved by Council.

The voting on all matters considered at the meeting is by a show of hands, unless otherwise determined by the Chairman.

An earnest appeal is made to all members of the Section to attend the meeting and to ensure the election of a committee truly representative of the Section. Nominations, duly proposed and seconded, should be sent to:—M. C. Campion, 6A Mildenhall Road, Clapton, E.5.

Alternatively, nominations may be proposed at the actual meeting as in previous years.

Following the meeting two films will be shown, one entitled "Supermarine" and the other, "Air Beef."

VISIT TO THE DE HAVILLAND AIRCRAFT COMPANY WORKS AT HATFIELD

A visit has been arranged for the morning of Saturday 26th May 1951 to the de Havilland Aircraft Co. Ltd. at Hatfield. This visit will be restricted to the first fifty members of the Section who notify the Honorary Secretary that they wish to attend.

Visitors will meet at the main gates of the factory at Hatfield at 9.30 a.m., where they will be met by guides and taken round the various sections of the factory, including the Comet production shops.

All those wishing to take part in this visit should inform M. C. Campion, 6A Mildenhall Road, Clapton, London, E.5, as soon as possible.

[P.T.O.

GRADUATES' AND STUDENTS' LEAFLET

For the past three years the JOURNAL has published a leaflet specially intended for Graduates and Students. This leaflet was in the nature of an experiment which has shown clearly that it is too limited in form to enable papers to be published in a way of most use to Graduates and Students.

From now on the leaflet will no longer be published. In its place pages will be reserved in the JOURNAL for the printing of papers written by members of the Graduates' and Students' Section. This will serve a double purpose. It will enable a paper to be published in its complete form instead of in instalments, and it will enable the papers to be an integral part of the JOURNAL, which the loose leaf method did not allow.

Members of the Section are invited to submit papers for publication. Papers should be kept short (not exceeding 3,000 words), and should be aimed at appealing to Graduates and Students.

Authors of such papers are particularly reminded that every year not only does the Society set aside £250 for Premium Awards for papers published in the JOURNAL, but it also offers special awards for Graduates and Students only.

The Committee of the Graduates' and Students' Section appeals to all members of the Section to make use of the considerable space now put at their disposal for papers. Papers should normally be sent in the first place to M. K. Bowden, Broadlands, St. George's Avenue, Weybridge, Surrey, but can be submitted direct if preferred by the author.

The success of this new venture depends entirely on the Graduates and Students themselves.

SECRETARY'S NEWS LETTER

FOR JUNE 1951

THE PRESIDENT—1951-52

Major F. B. Halford, C.B.E., F.R.Ae.S., took office as President of the Society at the Annual General Meeting held in the offices of the Society on 10th May 1951.

COUNCIL FOR 1951-52

The Council for 1951-52 is as follows:

President

Major F. B. Halford, C.B.E. (*Fellow*)

Past Presidents

Major G. P. Bulman, C.B.E., B.Sc. (*Fellow*)
Sir John S. Buchanan, C.B.E. (*Fellow*)
H. Roxbee Cox, Ph.D., B.Sc., D.I.C. (*Fellow*)

Vice-Presidents

S. Camm, C.B.E. (*Fellow*)
G. H. Dowty (*Fellow*)
G. R. Edwards, M.B.E., B.Sc. (*Fellow*)

Ordinary Members

Air Commodore F. R. Banks, C.B., O.B.E. (*Fellow*)
Lord Brabazon of Tara, M.C. (*Honorary Fellow*)
E. B. Dove (*Associate*)
A. G. Elliott, C.B.E., M.S.A.E. (*Fellow*)
W. S. Farren, C.B., M.B.E., M.A., F.R.S. (*Fellow*)
Sir A. H. Roy Fedden, M.B.E., D.Sc. (*Fellow*)
Sir Arthur Gouge, B.Sc. (*Fellow*)
Professor A. A. Hall, M.A. (*Fellow*)
S. Scott Hall, C.B., M.Sc., D.I.C., F.C.G.I. (*Fellow*)
N. J. Hancock (*Associate Fellow*)
E. T. Jones, O.B.E. (*Fellow*)
P. G. Masefield, M.A. (*Fellow*)
E. S. Moult, Ph.D., B.Sc. (*Fellow*)
W. E. W. Petter, B.A. (*Fellow*)
N. E. Rowe, C.B.E., B.Sc., D.I.C. (*Fellow*)
J. G. Roxburgh (*Graduate*)
W. Tye, O.B.E., B.Sc. (*Fellow*)
C. F. Uwins, O.B.E., A.F.C. (*Fellow*)

Honorary Treasurer: C. F. Uwins, O.B.E., A.F.C. (*Fellow*)
Honorary Librarian: J. E. Hodgson (*Honorary Fellow*)
Solicitor: L. A. Wingfield, M.C., D.F.C. (*Associate*)
Secretary: Captain J. Laurence Pritchard, C.B.E., Hon.F.I.Ae.S. (*Honorary Fellow*)

ANNUAL GENERAL MEETING

The Annual General Meeting of the Society was held at 4 Hamilton Place, W.1, on 10th May 1951, at which the Annual Report and Balance Sheets of The Royal Aeronautical Society and Aeronautical Trusts Ltd. for 1950 were approved. The complete Report and Balance Sheets were published in the April 1951 JOURNAL.

The following elections were announced at the Annual General Meeting:

Fellows: A. D. Baxter, H. T. Chapman, L. Howarth, M. S. Kuhring, M. J. O. Lobelle, J. Martin, E. Mensforth, F. W. Page, M. Roy, D. Williams, A. D. Young.

CONTENTS OF THE JUNE JOURNAL

Some Aspects of Flight Research, Handel Davies, M.Sc., F.R.Ae.S., A.F.I.Ae.S.
The Principles Underlying the Dynamic Stressing of Aeroplanes, D. Williams, F.R.Ae.S., M.I.Mech.E.
Indication, Measurement and Control of Ice Accretion, Air Commodore D. F. Lucking, R.A.F. (Rtd.), F.R.Ae.S., M.I.Mech.E.
New Zealand Division—Second Annual Report.
Reviews. Correspondence

The Council are particularly anxious to encourage members of the Society to support their own Journal by contributions to it of articles and papers on any aspect of Aeronautics. For that purpose they have set aside £250 a year in the form of premium awards to the authors (members or non-members) of such papers as some reimbursement for the work which has been done by the author. These premium awards are not fixed but vary from five to twenty guineas normally. It is hoped therefore that those members who have written papers on their special subjects will consider their own Journal in the first place.

THE AERONAUTICAL QUARTERLY—VOLUME III, PART I

Volume III, Part I, of "The Aeronautical Quarterly" is now available from the offices of the Society at 7s. 9d. a copy to members of the Society, post-paid, or 10s. 3d. to non-members, post-paid.

The contents of Part I, Volume III, are:—

The Symmetric Vibrations of Aircraft	R. W. Traill-Nash
Airscrews at Supersonic Forward Speeds	J. C. Burns
Polhausen's Method for Three - Dimensional Laminar Boundary Layers	J. C. Cooke
Supersonic Flow Past Bodies of Revolution with Thin Wings	P. M. Stocker

Copies of Volume II, Parts I to IV and a few copies of Volume I, Parts I to IV are still available, but members are reminded that a strictly limited edition only of "The Aeronautical Quarterly" is printed and numbers cannot be reprinted in any circumstances. An annual subscription to Volume III therefore is advisable.

SOCIETY OF BRITISH AIRCRAFT CONSTRUCTORS' EDUCATIONAL GRANTS

The attention of members is drawn to the Society of British Aircraft Constructors' Educational Grants administered by the Society.

The Grants are designed for the assistance of young men who are unable, for financial reasons, to obtain training in aeronautical engineering. All holders of S.B.A.C. grants are expected to qualify for a technical grade in the Royal Aeronautical Society.

Applicants should be between the ages of 16 and 18 on 1st September in the year of the award. The closing date for applications for this year is 30th June 1951. Application forms may be obtained from the Secretary.

ANGLO-AMERICAN AERONAUTICAL CONFERENCE

The Third Anglo-American Conference, to be held at Brighton from 3rd to 7th September, already shows signs of being most successful. A cable from New York from the Director of the Institute of the Aeronautical Sciences announced that over 80 Delegates have registered for the Conference and at least 40 of the Delegates will be bringing their wives. On the British side, at the time of going to press, some 200 registrations have been accepted and it is known that another 100 are being sent in during the next few weeks. Most of the major firms in the Aircraft Industry are each sending a number of official Delegates from their technical staffs, as well as allowing others who wish to "travel under their own steam" to do so. There will also be a considerable number of Delegates from the Ministry of Supply, Research Establishments, and so on, and representatives from the Universities.

Many of the British Delegates are bringing their wives and it is hoped to be able to arrange that the American and British ladies will have a number of opportunities of meeting one another outside purely Conference circles.

Great importance is attached to these Conferences apart from papers which may be read and discussion which may take place. In some respects, indeed, the printed papers may not be as important as the unprinted discussions which the Delegates will clearly have with one another and the close understandings and friendships which members of the two Societies (and their wives) will gain.

The first two Conferences demonstrated in ample measure how vitally important it was for these close relationships and understandings to be encouraged by every means possible. This Third Anglo-American Conference will lay particular emphasis on changing acquaintanceship to friendship, for upon the very closest friendship between the aeronautical technicians of the United States and Great Britain may depend the solution to many of the present world troubles.

The list of lectures which will be read and the days of their reading have already been published.

In such Conferences as these inevitably and rightly, the social side should be of lasting value. Sussex is a county which is full of interest for our American guests and arrangements are being made, for the American ladies especially, to visit those places which will appeal. It is hoped that some of the British ladies will take part in and help with these visits. Other visits, outside the county, may also be arranged as circumstances permit. The American Delegates themselves will have special opportunities to visit aircraft firms and the S.B.A.C. Flying Show which follows the Conference.

The Mayor of Brighton has very kindly and generously invited the Delegates and their ladies to a supper and dance in the Royal Pavilion (one of the most remarkable buildings in all Sussex) on Wednesday 5th September. On Monday 3rd September there will be an assembly function and on Friday 7th September a Conference Dinner.

The general arrangements of the Conference will follow the American pattern which has the great advantage of enabling the Delegates to keep closely in touch with each other during the pediod of the Conference. These general arrangements are the accommodation of the Delegates in two or three closely grouped hotels, and the holding of all the lectures and the refreshment arrangements (lunch and tea) in one building.

MEMBERS' NEW APPOINTMENTS

M. J. Brennan (*Associate Fellow*)—Deputy Chief Designer, Saunders-Roe Ltd.

H. T. Chapman (*Fellow*)—Appointed to the Board of the Hawker Siddeley Group.

A. G. Elliott (*Fellow*)—Joint Managing Director of Rolls-Royce Ltd.

W. A. Hargreaves (*Fellow*)—Blackburn & General Aircraft Ltd., elected to the Company's Board as Works Director and Managing Director of the Subsidiary Company.

E. S. Pearse (*Associate Fellow*)—Works Manager, Quickfit & Quartz Ltd.
A. Reynolds (*Associate Fellow*)—President of the Aluminium Development Association.

WRIGHT BROTHERS MEDAL

Mr. James C. Floyd, *Associate Fellow*, has been awarded the Wright Brothers Medal of the Society of Automotive Engineers.

NEWS OF BRANCHES

Major G. P. Bulman paid official visits as President of the Society to the following Branches in April:—

2nd April 1951—Derby Branch
13th April 1951—Hatfield Branch
24th April 1951—Preston Branch
25th April 1951—Glasgow Branch

OPEN EXHIBITIONS IN ENGINEERING AT SOUTHAMPTON UNIVERSITY COLLEGE

Two open entrance exhibitions, giving free instruction for three years in the Engineering Department of Southampton University College, are awarded annually by the Council of the College. These Exhibitions are intended for those who have had practical experience in an Engineering Works.

Candidates must have qualified for Matriculation of the University of London; the subjects of the examination must include Physics and Chemistry separately. Preferably, they should have passed the University of London Intermediate Examination for Engineers, or be exempt therefrom, and they must be prepared to read for a degree in Engineering.

There is no formal examination and no upper age limit.

ELECTIONS

The following is a list of new members and transfers of membership of the Society:—

Associate Fellows

Peter Henry Curnow (from Graduate), William Marlow Evans, Warren Hayward (from Graduate), Frank Edward Hunt (from Associate), James Arthur Randle Kay (from Associate), Gordon Geoffrey Levy, Peter Maurice William Noel (from Student), Frederick Herbert Parker, Cyril Arundel Pemberthy (from Associate), Herbert John Rix (from Associate), Alan John Salmon (from Associate), Joseph Goulding Sharp, John Hall Sinclair (from Associate), Victor William Steele (from Associate), William Laing Stewart, Geoffrey Arthur Virley Tyson (from Associate), Albert Maurel Uttley, Montague Wotton Wood (ex-Associate Fellow), Ronald Frederick Worlidge.

Associates

Ronald Winn Beatty, John Anderson Brennan, Ronald Campbell Cowan, Frederick James Ellen (from Companion), Frederick William Hailstone, Jack Morris Keene-Miller, John Desmond Monice, Laurence Charles Neill Penney, George Patrick Bentley Shaw-Yates, James Watt Wilson.

Graduates

Rene M. Bloch, Patrick Cornelius Donovan (from Student), John Richard Green, John Harold Horlock, John Laurence Horne (from Student), Laurie Hosking, Ronald George Knight (from Student), John Arthur Beverley Lambert (from Student), John

Mansell Lewendon, Alan John Leonard Mitchell, John Maxwell Roberts, Stuart Raymond Sarrailhé (from Student), Dennis William Taylor (from Student), Roy Thompson-Holland (from Student), Norman Turner, Kenneth Robin Warren (from Student), Robert Henry White (from Student).

Students

Leonard Bernstein, Michael John Broad, Peter William Fitt, Frederick James Hill, Thomas Guthrie Hunter, Zbigniew Jawor, Peter Numa Joubert, Shadi Lal, Edward Robert Albert Landers, John Malcolm Parr, Colin Gilbert Plane, Trevor Howard Powell, David Kenneth Dunn Rees, Alan Edmund Smith, Peter John Sole, Alexander Syme, John Edward Talbot, William John Taylor.

Companions

George Ivan Holyman, Leslie Dennis Howes.

CORRECTION TO DECEMBER 1950 JOURNAL

A misprint in decimal points has been noticed in the paper "Design Approximation of Skin Thickness from Stiffness Criteria" by A. H. Hall, A.R.Ae.S., in the December 1950 JOURNAL. In equations (17) and (18) on page 751 the factors should read .0187 and 0.48 instead of 0.187 and 4.8.

ENGINEERS AND MATHEMATICIANS

ENGINEERS and MATHEMATICIANS are invited by the Ministry of Supply to apply for an unestablished appointment in the grade of Senior Scientific Officer at the Royal Aircraft Establishment, Farnborough, Hants., for theoretical work on aircraft flutter as affecting aircraft design. The work involves the consideration of flutter problems on actual designs and the development of general design criteria for the prevention of flutter. Candidates must be at least 26 years of age and have a First or Second class honours degree in the appropriate subject. Experience of aircraft design work is essential and some experience of flutter or aeroelastic work is desirable.

Salary will be determined on age and on an assessment of the successful candidate's qualifications and experience within the range £670-£860. Rates for women are somewhat lower. The posts carry benefits of F.S.S.U.

Application forms are obtainable from the Ministry of Labour and National Service, Technical and Scientific Register (K), York House, Kingsway, W.C.2, quoting C 307/51A. Closing date: 22nd June, 1951. (H.Q. 417-20 5/51 A.W.)

APPLIED MATHEMATICIANS, PHYSICISTS, MECHANICAL OR AERONAUTICAL ENGINEERS

Applications are invited by the Ministry of Supply from APPLIED MATHEMATICIANS, PHYSICISTS or MECHANICAL or AERONAUTICAL ENGINEERS for an unestablished appointment in the grade of Senior Scientific Officer or Scientific Officer at an Experimental Aircraft Establishment in Southern England, for research investigations and flight testing techniques of helicopters. Candidates should have a First or Second class honours degree with experience in aerodynamics and interest in helicopters. For the Senior grade, candidates must be at least 26 years of age and have a minimum of 3 years' post-graduate research experience.

Salary will be determined on an assessment of the successful candidate's age, qualifications and experience within the ranges:—Senior Scientific Officer £670 to £860; Scientific Officer £380 to £620. Rates for women are somewhat lower. The posts carry benefits of F.S.S.U.

Application forms are obtainable from the Ministry of Labour and National Service, Technical and Scientific Register (K), York House, Kingsway, London, W.C.2, quoting A.157/51A. Closing date 22nd June 1951. (H.Q. 317-75 5/51 H.B.)

JOURNAL BINDING

The prices of binding of Journals are as follows:—

1950 Volume (including packing and postage), 16s. 0d.

Previous Volumes (including packing and postage), 18s. 0d.

Journals, with a note of the name and address of the sender, should be sent direct to The Lewes Press, Friars Walk, Lewes, Sussex, and the remittance to the Secretary at the offices of the Society.

Cases only for unbound 1950 Volumes are available, price 6s. 6d. each. Requests for cases, with remittances, should be sent to the Secretary at the offices of the Society.

CHANGES OF ADDRESS

To assist in keeping the records of members correct and up to date the Secretary will be glad if all members will notify him as soon as possible of changes of address.

When notifying changes please give the following particulars:—

Name (in block letters).

Grade of membership.

New address (in block letters).

Old address.

Changes of address must be received *before the 15th of the month* in order to be effective for the Journal for the following month.

ACKNOWLEDGMENT

The Council acknowledge with grateful thanks three volumes of *Aircraft Engineering*, presented by Dr. J. A. Jacobs.

ADDITIONS TO THE LIBRARY

The following have been added to the Library (titles of pamphlets are printed in italics. Books marked * or ** may not be taken out on loan):—

Anderson, E. W.	Principles of Air Navigation. Methuen. 1951.
British Compressed Air Society	Compressed Air Terms and Standards. 1951.
Crash Injury Research	Handbook for Aircraft Accident Investigators. Cornell University Medical College. 1951.
Dorman, G.	Fifty Years' Fly-Past. Forbes Robertson. 1951.
Guggenheim Aviation Safety Centre	Survey of Research Projects in the Field of Aviation Safety (a Bibliography). 1951.
Hadekel, R.	Displacement Pumps and Motors. Pitman. 1951.
Lattanzi, B.	Teoria e Tecnica dei Radiatori d'Aeroplano. Reprint "L'Ingegnere."
Miller C. M.	Kitecraft and Kite Tournaments. Manual Arts Press. 1914.
Ministry of Civil Aviation	Accidents to Aircraft of the U.K. to 31.12.49. H.M.S.O. 1950.
Perrie, D. W.	Cloud Physics. University of Toronto Press. 1950.
Thornton, D. L.	Mechanics Applied to Vibrations and Balancing. 2nd Edition. Chapman and Hall. 1951.
United Steel Companies Ltd.	Standard Methods of Analysis of Iron, Steel and Ferro-Alloys. 4th Edition. United Steel. 1951.
*Whittle, W. C. M. (Editor)	"The Aeroplane" Directory. 1951.

A.R.C. Current Papers

30—*An approximate method for the estimation of the design point efficiency of axial flow turbines. D. G. Ainley.*

33—*Influence of variable specific heats on the high-speed flow of air. J. Kestin.*

35—*A three-channel piezo-electric pressure recorder. P. J. Fletcher.*

36—*Cockpit lighting: a general survey of the principles and technique, with particular reference to the development of the dual system. E. S. Calvert.*

37—*Wind tunnel tests on a Griffith Meteor model (without suction). D. A. Clarke.*

38—*The air flow under the towing carriages in the R.A.E. seaplane tank. K. M. Tomaszewski, S. Raymond and G. F. Chalmers.*

39—*Low-speed wind tunnel investigation of the change in aerodynamic centre position and in C_{m_0} due to propeller turbine nacelles. D. A. Kirby and F. W. Dee.*

40—*Tests on A. W. Apollo (Brab. IIB) in the N.P.L. compressed air tunnel. C. Salter, C. J. W. Miles and P. S. Pusey.*

41—*Tests on the effect of incidence on some pressure heads at high subsonic speeds. E. W. E. Rogers and C. J. Berry.*

A.R.C. Reports and Memoranda

2327—*Research work in aircraft structures. P. B. Walker.*

2399—*Note on the application of the linearised theory for compressible flow to transonic speeds. A. Robinson and A. D. Young.*

2407—*An investigation into the suitability of proposed aircraft design memoranda tests for deck-landing aircraft (2 parts). D. Lean and J. R. Stott, with appendix to part I by P. A. Hufton.*

2417—*The fundamentals of flutter. W. J. Duncan.*

2422—*Flight tests of a Meteor I with two W2/B23 turbine engines equipped with modified jet pipe reheating. A. D. Baxter and C. Kell.*

2425—*Note on the pressure drop characteristics of baffles for use in wind-tunnel model tests of cooling duct systems. J. Seddon and A. Spence.*

2433—*The use of rubber models in stress investigations. D. Williams, R. D. Starkey and D. M. A. Leggett.*

2454—*Wind-tunnel tests on the Supermarine S.12/40, a monoplane amphibian with a variable incidence wing. H. V. Becker, R. Hills and M. A. Morrison.*

2455—*Further wind-tunnel tests on the Supermarine S.12/40, a monoplane amphibian with a variable incidence wing. H. V. Becker, R. Hills and H. Hogg.*

2456—*Wind-tunnel tests on the Folland E.28/40. Staff of the Royal Aircraft Establishment.*

2479—*Wind-tunnel investigation of fin and rudder accidents on heavy bombers (Halifax and Lancaster). C. H. E. Warren and J. A. Kirk.*

2484—*Experiments on air flow in the 7-foot open-jet No. 1 wind tunnel and application to wind-tunnel design. V. M. Falkner and H. L. Nixon.*

2503—*Rib loads at changes of section in a torsion box. D. Williams.*

2507—*Aileron tests on a Spitfire. D. E. Morris and M. B. Morgan, with an appendix by F. Grinsted.*

2510—*Experiments on the balancing of ailerons by geared tabs and trailing-edge strips. L. W. Bryant, C. H. Burge, N. E. Sweeting and J. R. Greening.*

2541—*Gas turbine design based on free vortex flow. E. A. Simonis and J. Reeman.*

2576—*Binary aileron—spring-tab flutter. G. A. Naylor and Anne Pellew.*

2586—*Some wind-tunnel developments of the spoiler as a form of lateral control. W. S. Coleman and G. H. Tidbury.*

2604—*A method of estimating the direct stress concentration round holes in reinforced sheet. M. Fine and Anne Pellew.*

Aeronautical Research Laboratories, Australia. Reports

A.73—*Skin friction in a retarded turbulent boundary layer near separation. B. G. Newman.*

S.M.164—*On the problem of shear lag in non-uniform cylindrical tubes. W. H. Wittrick.*

Instruments Note 51—*A design procedure for a simple automatic control for model aircraft. B. E. Swire.*

Engines Note 151—*The application of a method of rounding the nose of Lighthill aerofoil cascades. E. K. Webb.*

Engines Note 156—*The calculation of combustion efficiency by the heat balance method. R. E. Pavia.*

Ministère de l'air. France. Publications scientifiques et techniques

247—*Etude des corps plastiques sous pressions élevées. F. Charron.*

J. LAURENCE PRITCHARD,
Secretary,

THE ROYAL AERONAUTICAL SOCIETY
4 Hamilton Place, Piccadilly, London, W.1. Tel.: Grosvenor 3515-19

Made and printed in Great Britain by THE LEWES PRESS. Friars Walk, Lewes, Sx.

SECRETARY'S NEWS LETTER

FOR JULY 1951

AUGUST BANK HOLIDAY

The Library and offices of the Society wili be closed from 5 p.m. on Friday 3rd August until 9 a.m. on Tuesday 7th August 1951.

SPECIAL NOTICE TO MEMBERS

Dr. A. M. Ballantyne, *Associate Fellow*, takes over his duties as Secretary of the Society on Monday 2nd July 1951. Dr. Ballantyne was educated at Glasgow University where he took his B.Sc. degree in Engineering, and his Ph.D. He is an Associate Fellow of the Society, and an Associate Member of the Institution of Civil Engineers and of the Institution of Structural Engineers.

Captain J. Laurence Pritchard will be responsible for the organisation of the Anglo-American Aeronautical Conference to be held in Brighton in September.

THIRD ANGLO-AMERICAN CONFERENCE

The number of Registrations for the Third Anglo-American Conference has greatly exceeded expectations, both from the United States and this country. Many delegates from both countries will be accompanied by their wives. Altogether the number of those attending at Brighton exceeds 500, of whom 400 are delegates.

The number of Registrations at present indicates that no further applications to membership of the Conference can be accepted after Monday, 23rd July 1951.

SOCIETY STAFF REQUIREMENTS

Applications are invited for the posts of senior technicians to guide and take part in the preparation of the Society's Data Sheets, particularly those on Aerodynamics and Structures.

Applicants should have had experience in the abstraction and use of experimental, test and theoretical information from official and other sources.

Salaries will be on a scale comparable to those for Senior Scientific Officers, £700 × £25 to £900.

Applications must be made in writing to the Secretary and marked *Confidential.*

There is also a vacancy for a draughtswoman-tracer on the Technical Staff of the Society.

CONTENTS OF THE JULY JOURNAL

Progress Towards Electrical Serviceability, R. H. Woodall, M.I.E.E., A.F.R.Ae.S., and V. A. Higgs, B.Sc., A.M.I.E.E., A.F.R.Ae.S.

Progress Towards Hydraulic Serviceability, R. H. Bound, F.R.Ae.S., and H. G. Conway, F.R.Ae.S., M.A., M.I.Mech.E.

1951 Garden Party.

Reviews. Correspondence.

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The Journal awards for 1950 will be published in the August News Letter.

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ADVERTISEMENTS

From time to time paid advertisements offering technical posts in Government establishments and in the Aircraft Industry have been published in the "Secretary's News Letter" (formerly "Monthly Notices"). In order to avoid any misunderstanding it has been decided that this practice should be discontinued. Instead, the last page of the advertisement section at the back of the JOURNAL has been set aside for such advertisements.

Beginning with the July 1951 JOURNAL this page is available for the advertising of technical posts in the Industry, in official establishments, in Universities and Colleges and for advertisements from members of situations required. The rates for such advertisements are available on application to the Editor.

ELLIOTT MEMORIAL PRIZE

The Elliott Memorial Prize has been awarded to Sergeant Aircraft Apprentice D. Allison of the September 1948 Entry at R.A.F., Halton, who has obtained the highest marks in the General Studies Examination. The prize will be presented at the Graduation Prize Giving on 31st July 1951.

BIRTHDAY HONOURS

The President and Council congratulate the following members whose names were included in the Birthday Honours List:—

C.B.E.

H. T. Chapman, *Fellow*; G. W. H. Gardner, *Fellow*; W. E. W. Petter, *Fellow*.

O.B.E.

H. E. Hancocke, *Associate Fellow*.

A.F.C.

S./Ldr. A. E. Callard, *Associate*; Cdr. (E) P. S. Wilson, *Associate Fellow*.

M.B.E.

G. Maclaren Humphreys, *Associate Fellow*.

MEMBERS' NEW APPOINTMENTS

D. C. Allen (*Associate Fellow*)—Engineer, Scientific Services Division, Snowy Mountain Hydro-Electric Authority, Sydney, N.S.W.

C. F. Caunter (*Associate Fellow*)—Assistant Keeper 1st Class, Science Museum, South Kensington.

F. G. Evans (*Fellow*)—Engineering Development Group Manager (Isotopes), Division of Atomic Energy (Production).

Professor A. A. Hall (*Fellow*)—Director, Royal Aircraft Establishment.

P. V. Hoare (*Associate Fellow*)—Assistant to the Managing Director, Westland Aircraft Limited.

G. E. Petty (*Fellow*)—Technical Adviser, Blackburn and General Aircraft Ltd.

ASSOCIATE FELLOWSHIP EXAMINATION

Home entries for the December 1951 Associate Fellowship Examination should be received by the Secretary not later than the 31st August 1951. The lists for entries outside the United Kingdom have been closed.

HELICOPTERS IN PEACE AND WAR

Mr. Igor Sikorsky will deliver a lecture on "Helicopters in Peace and War" before the Helicopter Association of Great Britain on Tuesday 17th July 1951, at 5.30 p.m., at the Institution of Civil Engineers, Great George Street, London, S.W.1.

The Helicopter Association have kindly invited members of the Society to attend the lecture.

ELECTIONS

The following is a list of new members and transfers of membership of the Society:—

Associate Fellows

Humphrey Chetwood
Geoffrey St. Quinton Crockett (from Graduate)
David Jeffrey Goman (from Associate)
John Charles Hamon (from Graduate)
George William Jones
John Alexander Kent (from Associate)
George Geoffrey Legg (from Graduate)
James Robert MacLachlan
Maurice Edward Maxwell (ex-Graduate)
William Farquhar Murray
Leslie William James Newman
Alan Pyke

Associates

Edward Michael Bellamy
Harold William Boothroyde
Robert Joseph Evans
Stephen Frederick Hemsted
Clifford John Le Couteur
James Leggat (from Student)
Robert Ward Leslie
Arnold McArthy
Harold Josiah Shipp
Richard Kenneth Slatter
William Charles George Smith
Willoughby Sidney Worner
John Esmond Yates-Earl

Graduates

Peter Phillip Benham (from Student)
Bryan Robert Alexander Burns (from Student)
Francis Herbert Carr
John Charles Chicken (from Student)
John Cyril Fell
Maurice Massey Gates
David Harris (from Student)
Robin Edward Keates
John William Paulsen (from Student)
Lionel Rossiter Pool (from Student)
Ian Frederick Watson (from Student)

Students

John Howard Ansley
Bruce Roy Aubin
Harry Grant Boyne
John Robert Burton
David Charles Lavis Francis
Robert Angus Gee
Brian Herbert Guest
Basil Hull
John Leese
Ronald Clive Lovett
Basil Ronald Messenger
Francis Ian Victor Walker
Robert Willoughby

Companions

Guillermo Gonzaler Gomez
Jens Rainer Maria Radok
Charles Frederick Towell

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The Council acknowledge with thanks the return of back numbers of the JOURNAL from A. M. Desoutter, A.F.R.Ae.S.

ADDITIONS TO THE LIBRARY

The following have been added to the Library (titles of pamphlets are printed in italics. Books marked * or ** may not be taken out on loan):—

Bowden, C. E.	Diesel Model Engines. 3rd Edition. Percival Marshall. 1951.
Bureau of Ordnance	Handbook of Supersonic Aerodynamics, Navord Report, 1448. Volume 2. U.S.G.P.O. 1950.
Devons, E.	Planning in Practice. C.U.P. 1950.
Lawrence, W. J.	No. 5 Bomber Group: R.A.F. (1939-45). Faber and Faber. 1951.
Low, A. R.	Normal Elliptic Functions. University of Toronto. 1950.
Massachusetts Institute of Technology	Proceedings: Conference on Ground Facilities for Air Transportation. M.I.T. 1950.
Ministry of Civil Aviation	*Aviation Law for Private Pilots.* H.M.S.O. 1951.
Mond Nickel Co. Ltd.	Isothermal Transformation Diagrams for Nickel Steels. 1951.
Morley, A. W.	Performance of a Piston-Type Aero-Engine. Pitman. 1951.
Morse, P. M., and G. E. Kimball	Methods of Operations Research. Chapman Hall. 1951.
Muskhelishvili, N. I.	Singular Integral Equations. Aeronautical Research Laboratories (Melbourne). 1949.
Nenadovic, M.	Osnovi Aerodinamickih Konstrukcija: Aeroprofili. 2 volumes. University of Belgrade. 1948.
	Osnovi Aerodinamickih Konstrukcija: Elise. University of Belgrade. 1949.
Pope, A.	Basic Wing and Airfoil Theory. McGraw-Hill. 1951.
Rogerson, E. C.	The Industrial Gas Turbine. Temple Press. 1951.
Rowe, N. E.	Helicopters Applied to Local Air Service Operation: British Experience and Requirements. (Preprint). S.A.E. 1951.
Sauer, R.	Ecoulements des fluides compressibles. Ch. Béranger, Paris. 1951.
Streeter, V. L.	Fluid Mechanics. McGraw Hill. 1951.
*UNESCO	Directory of International Scientific Organizations. UNESCO. 1951.
Welsh, R. J., and G. Waller	The Gas Turbine Manual. Temple Press. 1951.
Whittingham, Sir Harold	*Air Transport of Pregnant Women.* "The Practitioner." 1951.
	Aviation Medicine. B.M.A. Proceedings. 1948.
	Preventive Medicine in the R.A.F. Journal R.I.P.H. & H. 1944.
	Control of Water and Food Supplies on Air Routes. "Public Health." 1949.
Whittingham, Barbour and MacGown	*Medical Fitness for Air Travel.* British Medical Journal. 1949.

A.R.C. Reports and Memoranda

2438—*The efficiency of airscrews on wings of large chord. E. Ower and R. Warden.*

2465—*Calculation of the interference on a thin symmetrical aerofoil with hinged flap spanning a closed wind-tunnel. J. H. Preston and A. R. Manwell.*

2468—*Pitot-tube readings near shock waves in the N.P.L. and R.A.E. high speed tunnels. R. G. Fowler.*

2478—*Distortion of control surface panels. D. M. A. Leggett and R. G. Chapman.*

2533—*An experimental investigation of the effect of localised masses on the flutter of a model wing. N. C. Lambourne and D. Weston.*

2566—*Calibration of the Royal Aircraft Establishment 24-ft. wind tunnel. J. E. Allen and K. V. Diprose.*

2648—*A comparison between plain and stringer-reinforced sheet from the shear lag standpoint. M. Fine.*

The College of Aeronautics, Cranfield. Reports

43—*Measurements of the pressure distribution on sweptback wings with trailing edge split flaps. A. W. Babister.*

44—*The evaluation of matrix elements for the analysis of sweptback wing structures by the method of oblique co-ordinates. S. R. Lewis.*

45—*Tests on the general instability of a stiffened metal cylinder under axial compression. W. R. Heald.*

Aeronautical Research Laboratories, Australia

Report SM. 166—*The effect of grain size on the structural changes produced in aluminium by slow deformation. W. A. Rachinger.*

Engines Note 154—*Static pressures and air flows in the flame tube of a Derwent V combustor. R. E. Pavia.*

Structures and Materials Note 186—*The characteristic numbers and coefficients of Mathieu's equation. J. Guest.*

National Research Council of Canada. Reports

MA 232—*Ejector theory and its application to induction type wind tunnels. W. R. Laidlaw.*

ME 186—*Spray nozzles for the simulation of cloud conditions in icing tests of jet engines. N. Golitzine, C. R. Sharp and L. G. Badham.*

MF 2891—*Literature review on the prevention of ice crystal formation in fuels. J. M. Lloy.*

MF 2905—*The viscosity-surface tension relation for petroleum fuels. W. Sacks.*

MM 222—*Report on observations of the behaviour of a family of plastic wing models under dead weight and aerodynamic loads. A. H. Hall.*

MM 225—*Aircraft ski research in Canada. G. J. Klein.*

MT 10—*Shock tube theory and applications. J. Lukasiewicz.*

MT 11—*Flow in a shock tube of non-uniform cross-section. J. Lukasiewicz.*

Ministère de l'Air. France. Publications scientifiques et techniques

N.T.41—*Les aspects fondamentaux de la thermocinétique. P. Vernotte.*

B.S.T.114—*Contribution a l'étude des avions a ailes déformables. R. Rouanet.*

O.N.E.R.A. Notes Techniques

No. 1—*Appropriation des réacteurs a la propulsion des avions supersoniques. M. Roy.*

No. 2—*Étude du flutter en régime supersonique; le flutter flexion-torsion (problème-plan). R. Weber et W. Ruppel.*

No. 3—*Détermination par le calcul et par essais en soufflerie des vitesses critiques de vibration d'une maquette plane a deux degrés de liberté: rotation de l'aile et rotation de l'aileron. J. Dorr.*

Nationaal Luchtvaartlaboratorium, Amsterdam

Report F. 64—*Catalogue of aerodynamic measurements. J. H. Greidanus and A. C. De Kock.*

Aeronautical Research Institute. Sweden. Reports (in English)

37—*Measurements of the pressure distribution on rectangular wings of different aspect ratios. O. A. M. Holme.*

38—*Theoretical calculation of the downwash factor for unswept trapezoidal wings with regard to the compressibility for subsonic velocities. W. Jacobs.*

National Advisory Committee for Aeronautics, U.S.A.

Reports

941—*Prediction of the effects of propeller operation on the static longitudinal stability of single-engine tractor monoplanes with flaps retracted. J. Weil and W. C. Sleeman, Jr.*

942—*Investigation in the Langley 19-foot pressure tunnel of two wings of NACA 65-210 and 64-210 airfoil sections with various type flaps. J. C. Sivells and S. H. Spooner.*

946—*Plastic buckling of a rectangular plate under edge thrusts. G. H. Handelman and W. Prager.*

950—*Investigations of a systematic group of NACA 1-series cowlings with and without spinners. M. R. Nichols and A. L. Keith, Jr.*

955—*Application of radial-equilibrium condition to axial-flow compressor and turbine design. Chung-Hua Wu and L. Wolfenstein.*

959—*One-dimensional flows of an imperfect diatomic gas. A. J. Eggers, Jr.*

960—*Determination of plate compressive strengths at elevated temperatures. G. J. Heimerl and W. M. Roberts.*

963—*Investigation with an interferometer of the turbulent mixing of a free supersonic jet. P. B. Gooderum, G. P. Wood and M. J. Brevoort.*

964—*The effects of variations in Reynolds number between 3.0 × 10^6 and 25.0 × 10^6 upon the aerodynamic characteristics of a number of NACA 6-series airfoil sections. L. K. Lofton, Jr. and W. J. Bursnall.*

965—*The longitudinal stability of elastic swept wings at supersonic speed. C. W. Frick and R. S. Chubb.*

967—*Elastic and plastic buckling of simply supported solid-core sandwich plates in compression. P. Seide and E. Z. Stowell.*

969—*Some theoretical low-speed span loading characteristics of swept wings in roll and sideslip. J. D. Bird.*

973—*Flight investigation of the effect of various vertical-tail modifications on the directional stability and control characteristics of a propeller-driven fighter airplane. H. I. Johnson.*

974—*The supersonic axial-flow compressor. A. Kantrowitz.*

975—*Small bending and stretching of sandwich-type shells. E. Reissner.*

977—*Frequency response of linear systems from transient data. M. E. Laverne and A. S. Boksenbom.*

978—*Method of designing cascade blades with prescribed velocity distributions in compressible potential flows. G. R. Costello.*

979—*On stability of free laminar boundary layer between parallel streams. M. Lessen.*

980—*General algebraic method applied to control analysis of complex engine types. A. S. Boksenbom and R. Hood.*

984—*Method for determining the frequency-response characteristics of an element or system from the system transient output response to a known input function. H. J. Curfman, Jr. and R. A. Gardiner.*

985—*A radar method of calibrating airspeed installations on airplanes in maneuvers at high altitudes and at transonic and supersonic speeds. J. A. Zalovcik.*

987—*Equilibrium operating performance of axial-flow turbo-jet engines by means of idealized analysis. J. C. Sanders and E. C. Chapin.*

995—*Blockage corrections for three-dimensional-flow closed-throat wind tunnels, with consideration of the effect of compressibility. J. G. Herriot.*

***Technical Memoranda**

1241—*Basic differential equations in general theory of elastic shells. V. S. Vlasov.*

1299—*Additional measurements of the drag of surface irregularities in turbulent boundary layers. W. Tillmann.*

1262—*Turbulence and heat stratification. H. Schlichting.*

J. LAURENCE PRITCHARD,

27th June 1951 *Secretary*

THE ROYAL AERONAUTICAL SOCIETY
4 Hamilton Place, Piccadilly, London, W.1. Tel.: Grosvenor 3515-19

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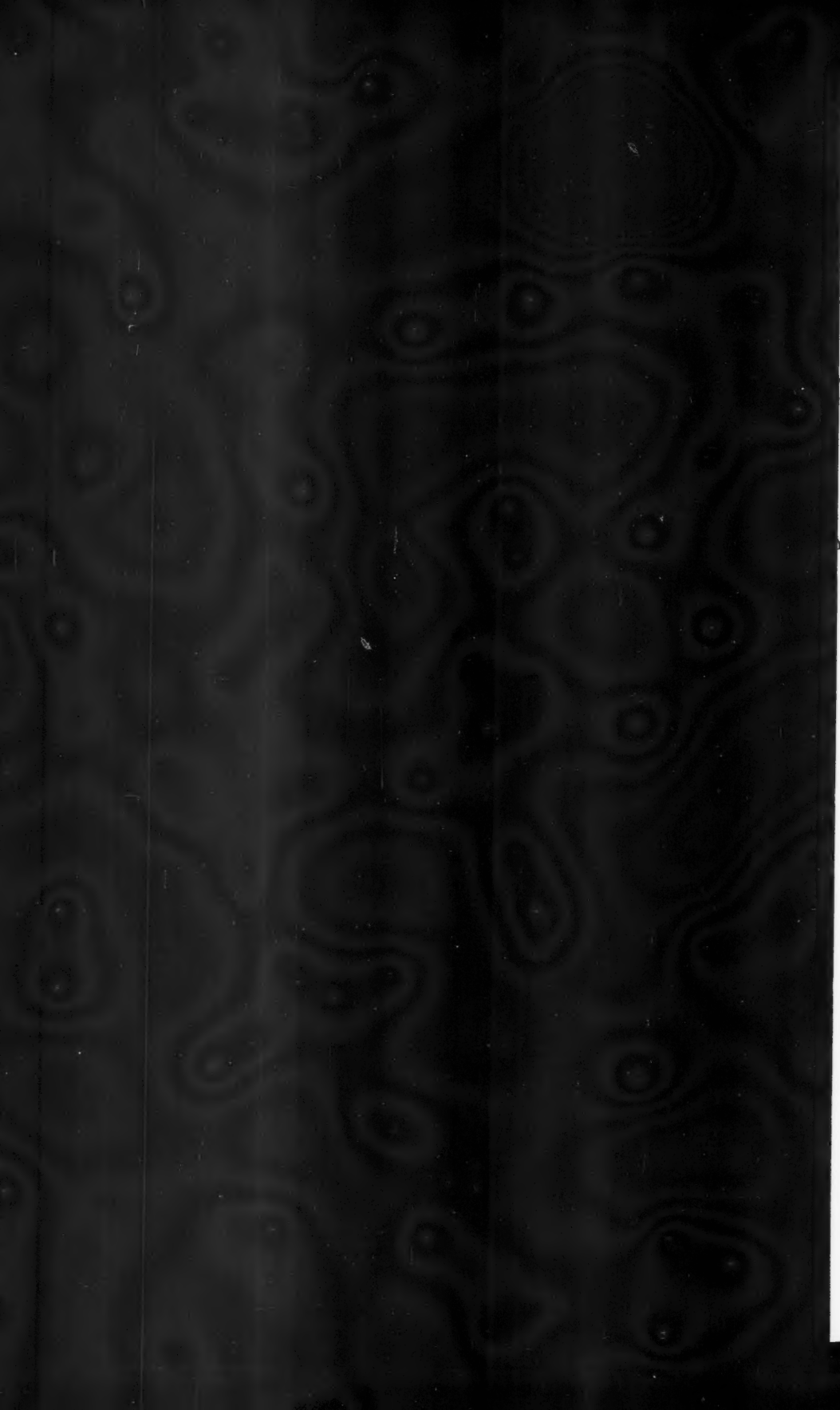

SECRETARY'S NEWS LETTER

FOR AUGUST 1951

THIRD ANGLO-AMERICAN AERONAUTICAL CONFERENCE

Final preparations are now being made for the Third Anglo-American Aeronautical Conference which will be held at Brighton from the 3rd to the 7th September 1951. Altogether the number of those attending at Brighton will be about 700, of whom 500 are delegates, including more than 90 from the Institute of The Aeronautical Sciences.

All delegates will receive full details of the arrangements for the technical and social activities of the Conference by the end of August, together with 19 of the 20 papers to be presented. It is hoped that the last paper will be available for distribution on 3rd September.

39th WILBUR WRIGHT MEMORIAL LECTURE

The 39th Wilbur Wright Memorial Lecture will be held at the Royal Institution, 21 Albemarle Street, W.1, on 10th September 1951 at 6 p.m. and not at the Institution of Civil Engineers. The lecture will be read by Mr. A. E. Raymond, of the Douglas Aircraft Corporation, California, on "The Well-Tempered Aircraft."

Tea will be served at 5.30 at the Royal Institution.

A Reception following this lecture will be held in the offices of the Society from 8-11 p.m. Members have already been sent full particulars and should apply for their tickets immediately as the numbers are strictly limited.

SEVENTH BRITISH COMMONWEALTH AND EMPIRE LECTURE

The Seventh British Commonwealth and Empire Lecture will be held at the Institution of Civil Engineers, Great George Street, S.W.1, on 4th October 1951 at 6 p.m. The lecture will be read by Air Vice-Marshal Sir Leonard Isitt, K.B.E., R.N.Z.A.F., of New Zealand, on "Air Transport in New Zealand and the South Pacific."

Tea will be served at 5.30 p.m. at the Institution of Civil Engineers.

SOCIETY STAFF REQUIREMENTS

Applications are invited for the posts of senior technicians to guide and take part in the preparation of the Society's Data Sheets, particularly those on Aerodynamics and Structures.

Applicants should have had experience in the abstraction and use of experimental, test and theoretical information from official and other sources.

Salaries will be on a scale comparable to those for Senior Scientific Officers, £700 × £25 to £900.

Applications must be made in writing to the Secretary and marked *Confidential*.

There is also a vacancy for a draughtswoman-tracer on the Technical Staff of the Society.

CONTENTS OF THE AUGUST JOURNAL

Planning and Production Methods used in the Construction of the D.H. Comet, H. Povey, A.F.R.Ae.S.

Reviews. Correspondence.

The Council are particularly anxious to encourage members of the Society to support their own Journal by contributions to it of articles and papers on any aspect of Aeronautics. For that purpose they have set aside £250 a year in the form of premium awards to the authors (members or non-members) of such papers as some reimbursement for the work which has been done by the author. These premium awards are not fixed but vary from five to twenty guineas normally. It is hoped therefore that those members who have written papers on their special subjects will consider their own Journal in the first place.

THE AERONAUTICAL QUARTERLY

Because of the amount of printing to be done in connection with the Third Anglo-American Aeronautical Conference, Part II, Volume III of the Aeronautical Quarterly has been delayed. It is expected to be available about the middle of September. The Contents of Part II, Volume III will be:—

The Construction and Testing of a Xylonite Model of a Delta Aircraft	S. C. Redshaw and P. J. Palmer
A Note on the Stressing of Oleo-Pneumatic Shock Absorbers	D. M. A. Leggett
The Anti-Symmetric Vibrations of Aircraft	R. W. Traill-Nash
The Flow of an Incompressible Fluid through an Axial Turbo-Machine witr any Number of Rows	J. W. Railly

Copies of Volume III, Part I, of "The Aeronautical Quarterly" are still available from the offices of the Society at 7s. 9d. a copy to members of the Society, post-paid, or 10s. 3d. to non-members, post-paid.

The contents of Part I, Volume III, are:—

The Symmetric Vibrations of Aircraft	R. W. Traill-Nash
Airscrews at Supersonic Forward Speeds	J. C. Burns
Polhausen's Method for Three - Dimensional Laminar Boundary Layers	J. C. Cooke
Supersonic Flow Past Bodies of Revolution with Thin Wings	P. M. Stocker

Copies of Volume II, Parts I to IV and a few copies of Volume I, Parts I to IV are still available, but members are reminded that a strictly limited edition only of "The Aeronautical Quarterly" is printed and numbers cannot be reprinted in any circumstances. An annual subscription to Volume III therefore is advisable.

MEMBERS' NEW APPOINTMENTS

L. G. Frise (*Fellow*)—Technical Director, Board of Percival Aircraft Ltd.

H. E. Hancocke (*Associate Fellow*)—Director of Aircraft Production, Ministry of Supply.

J. A. Jacobs (*Associate Fellow*)—Associate Professor (Applied Mathematics), University of Toronto, Canada.

E. Mensforth (*Fellow*)—President of the Helicopter Association.

SOCIETY OF BRITISH AIRCRAFT CONSTRUCTORS' EDUCATIONAL GRANTS

The following applicants were awarded Educational Grants by the Society of British Aircraft Constructors at a Selection Committee meeting held in the offices of the Royal Aeronautical Society on 24th July 1951:—

R. E. Catterwell, Suffolk House, Princes Road, Weybridge, Surrey.
Clive W. Hicks, 89 Queens Road, Banbury, Oxon.
G. Rampling, 3 Park View Road, Ipswich, Suffolk.
W. H. Corner, 7 Keynor Estate, Sidlesham, near Chichester, Sussex.
J. W. Sowerby, Shiney Row, Newbiggin-in-Teesdale, Barnard Castle, Co. Durham.

ASSOCIATE FELLOWSHIP EXAMINATION DECEMBER 1951

Candidates wishing to enter for the December 1951 Associate Fellowship Examination are reminded that forms should be sent in by 31st August 1951. Entry forms can be obtained on application to the Secretary.

ASSOCIATE FELLOWSHIP EXAMINATION RESULTS, MAY 1951

The following candidates were successful in Part I of the Associate Fellowship Examination held in May 1951:—

D. S. Bliss, R. Boocock, F. J. Butters, L. J. Geering, C. Mullen, J. M. O'Connell, M. D. Bernard-Smith, P. C. G. Stalkartt, D. Ross Turner, D. Wood.

The following candidates were successful in Part II held in May 1951:—

J. A. H. Bailie, G. H. A. Fenton, J. D. Mann, L. F. Nicholls, R. C. L. Sample, M. J. Taylor, D. W. Wall, E. G. Wilkinson.

AERONAUTICAL INFORMATION

ASLIB (Association of Special Libraries and Information Bureaux), is establishing an aeronautical information study group to bring together librarians, information officers, and others interested in the subject. The inaugural meeting is to be held on Thursday 27th September at the Royal Aircraft Establishment.

Full particulars may be obtained from the Director, ASLIB, 4 Palace Gate, London, W.8. Early application is advised.

ELECTIONS

The following is a list of new members and transfers of membership of the Society:—

Associate Fellows

Ralph Beasley
Horace Charles Bellamy
Ronald Arthur Berridge (from *Graduate*)
Leonard Ernest Bunnett (from *Associate*)
Ronald Terence Bunting
Keith Busby
Arthur Valentine Cleaver (from *Associate*)
Ivor John Davies
Karl Heinrich Doetsch
Joseph Cyril Guttridge (from *Graduate*)
William Robert Hawks (from *Graduate*)
Dennis Stanley Houghton (from *Graduate*)
Ronald Matthews Howarth
Edward Francis John
Stanley Ian Robertson Nicol (from *Graduate*)
Richard Allen Scarth Moss
Albert George Smith
Robert Dixon Speas
Gordon Thripp
Isaac Torbe
Norman Kenneth Walker
Kenneth Gordon Wallace (from *Associate*)
Charles Frederick Wills (from *Associate*)
Charles Alastair Wood-Collins (from *Associate*)
Dudley Harvey Wright
Syed Yusuff

Associates

John Nicholas Bean
John Clement Bell
Walter Eric Brown
Arthur Vincent Branscombe
Joseph Montague Caudle
Thomas Duncan Chapman
Harold Williams Chiverton
Neville Frederick Duke
Raymond Hart (from *Student*)
John Hunter
Richard Buckingham Keusch
Ralph Kirke
Arthur Craven Ledger
Frederick Henry Edwards Maidment
Bernard Stanley Murphy
Sidney Major Russell

Graduates

Francis Henry Borlace (from Student)
Henry Mervyn Briscoe
William Edward Thomas Cawsey (from *Student*)
James Joseph Foody
Maruti Kishor
Patrick Gerrard McCabe
Robert Victor Read (from *Student*)
Christopher John Rogers (from *Student*)
Gordon Sim (from *Student*)
George Walter Yates

Students

Henry Beresford
William Roderick Burge
Leon Charles
Peter Neville Cornall
Anthony John Heath
Richard Godfrey Palgrave Hood
John Victor Houghton
Andrew Kedar
Frederick Stephen Lynam
John Stuart Mitchell
Edwin Mowforth
Derek Olley
Rolf Person
John Leonard Spatcher
Richard Henry Percival Timms
Ronald Thomas Upton

Companions

George Francis Hugh Hemsley
Bernard Albert Hunn
Stanley Smith
Thomas Walter White

JOURNAL BINDING

The prices of binding of Journals are as follows:—

1950 Volume (including packing and postage), 16s. 0d.

Previous Volumes (including packing and postage), 18s. 0d.

Journals, with a note of the name and address of the sender, should be sent direct to The Lewes Press, Friars Walk, Lewes, Sussex, and the remittance to the Secretary at the offices of the Society.

Cases only for unbound 1950 Volumes are available, price 6s. 6d. each. Requests for cases, with remittances, should be sent to the Secretary at the offices of the Society.

CHANGES OF ADDRESS

To assist in keeping the records of members correct and up to date the Secretary will be glad if all members will notify him as soon as possible of changes of address.

When notifying changes please give the following particulars:—

Name (in block letters).

Grade of membership.

New address (in block letters).

Old address.

Changes of address must be received *before the 15th of the month* in order to be effective for the Journal for the following month.

ACKNOWLEDGMENTS

The Council acknowledge with grateful thanks the presentation of books to the Library from P. V. Hoare, *Fellow*, and the return of back numbers of the JOURNAL from R. L. Carter, Esq., *Associate*; Miss L. Chitty, *Fellow*; Wing Commander D. M. Egan, *Associate*, and D. M. Smith, Esq., *Fellow*.

ADDITIONS TO THE LIBRARY

The following have been added to the Library (titles of pamphlets are printed in italics. Books marked * or ** may not be taken out on loan):—

*Anglo-Iranian Oil Co. Ltd.	Our Industry. 1949.
A.S.T.M.	Symposium on Plasticity and Creep of Metals. 1950.
A.S.T.M.	Symposium on Ultrasonic Testing. 1949.
Brown, G. S. and D. P. Campbell	Principles of Servomechanisms. Chapman and Hall. 1948.
Cadell, C. S. and B. J. O'Kane	*Forty Years' Progress in Air Radio. Preprint from the Joint Engineering Conference* 1951.
Dawson, J. A.	*Planning and Construction of Airfields. Preprint from the Joint Engineering Conference* 1951.
Durham, F. P.	Aircraft Jet Power Plants. Prentice Hall. 1951.
Frenkiel, F. N.	Introduction to some Topics on Turbulence. University of Maryland. 1950.
Goldstein, S.	Linearized Theory of Supersonic Flow. University of Maryland. 1950.
Hall, N. A.	Thermodynamics of Fluid Flow. Prentice Hall. 1951.
Institute of Physics	Some Aspects of Fluid Flow. Edward Arnold. 1951.
Kampé de Feriet, J.	Mathematical Methods Used in the Statistical Theory of Turbulence. University of Maryland. 1950.
Kelly, F. C.	The Wright Brothers. A Biography. Harcourt, Brace and Co. 1943.
Kelly, F. C. (ed.)	Miracle at Kitty Hawk. The Letters of Wilbur and Orville Wright. Farrar, Strauss and Young. 1951.
Langdon-Davies, J.	Jubilee Book of the National Physical Laboratory. H.M.S.O. 1951.
Neville, L. E.	Aircraft Designers' Data Book. McGraw-Hill. 1950.
Niles, A. S. and J. S. Newell	Airplane Structures. Vols. I and II. 3rd edition. J. Wiley and Sons. 1943.
Owner, F. M.	*The Application of Power to Aircraft. Preprint from the Joint Engineering Conference* 1951.

Pugsley, A. G.	*Development and Design of Aircraft Structures. Preprint from the Joint Engineering Conference* 1951.
Tufts College Institute for Applied Experimental Psychology	Handbook of Human Engineering Data for Design Engineers. U.S. Dept. of the Navy. 1949.
The Wonder Book of the R.A.F.	Ward, Lock and Co. 1951.

A.R.C. Reports and Memoranda

2480—*Wing flexure-aileron flutter tests on a model of B.A.C. wing type 167. G. Scruton.*

2526—*Note on differential gearing as a means of aileron balance. S. B. Gates.*

The College of Aeronautics, Cranfield. Reports

46—*The use of a potential flow tank for testing axi-symmetric contraction shapes suitable for wind tunnels. A. W. Babister, W. S. D. Marshall, G. M. Lilley, E. C. Sills and S. R. Deards.*

47—*Vibrations of a swept box. J. M. Radok.*

Aeronautical Research Laboratories, Australia

Engines Note 155—*The Derwent V combustor with separated air supplies. 1 Atomizer effects with normal air distribution. R. E. Pavia.*

Ministère de l'air, France. Publications Scientifiques et Techniques

No. 248—*Actes du colloque international de mécanique. Poitiers 1950.*

National Luchtvaartlaboratorium, Amsterdam

*Report V.*1463—*Emergency landing after power-failure with a Sikorsky S-51 helicopter. L. R. Lucassen, J. Meijer Drees and E. C. Senger.*

National Advisory Committee for Aeronautics, U.S.A.
Reports

968—*Investigation at low speeds of the effect of aspect ratio and sweep on rolling stability derivatives of untapered wings. A. Goodman and L. R. Fisher.*

983—*Line-vortex theory for calculation of supersonic downwash. H. Mirels and R. C. Haefeli.*

986—*The reversibility theorem for thin airfoils in subsonic and supersonic flow. C. E. Brown.*

989—*Critical stress of ring-stiffened cylinders in torsion. M. Stein, J. Lyell Sanders, Jr., and H. Crate.*

998—*Further experiments of the flow and heat transfer in a heated turbulent air jet. S. Corrsin and M. S. Uberoi.*

***Technical Memoranda**

1276—*Sideslip in a viscous compressible gas. V. V. Struminsky.*

1286—*Method of successive approximations for the solution of certain problems in aerodynamics. M. E. Shvets.*

1294—*Exhaust turbine and jet propulsion systems. K. Leist and E. Knornschild.*

1297—*State and development of flutter calculation. A. Teichmann.*

1312—*Calculation of the bending stresses in helicopter rotor blades. P. de Guillenchmidt.*

***Technical Notes**

1911—*Physical properties at elevated temperature of seven hot-pressed ceramics. J. J. Gangler, C. F. Robards and J. E. McNutt.*

2238—*Effects on longitudinal stability and control characteristics of a B-29 airplane of variations in stick-force and control-rate characteristics obtained through use of a booster in the elevator-control system. C. W. Mathews, D. B. Talmage and J. B. Whitten.*

2266—*Strength of heat-resistant laminates up to 375°C. B. M. Axilrod and M. A. Sherman.*

2276—*Static and fatigue strengths of high-strength aluminum-alloy bolted joints. E. C. Hartmann, M. Holt and I. D. Eaton.*

2279—*Three-dimensional compressible laminar boundary-layer flow. F. K. Moore.*

2281—*Detailed computational procedure for design of cascade blades with prescribed velocity distributions in compressible potential flows. G. R. Costello, R. L. Cummings and J. T. Sinnette, Jr.*

2282—*An improved approximate method for calculating lift distributions due to twist. J. C. Sivells.*

2283—*Method for calculating lift distributions for unswept wings with flaps or ailerons by use of nonlinear section lift data. J. C. Sivells and G. C. Westrick.*

2284—*Lift, pitching moment, and span load characteristics of wings at low speed as affected by variations of sweep and aspect ratio. E. J. Hopkins.*

2285—*Damping in roll of cruciform and some related delta wings at supersonic speeds. H. S. Ribner.*

2286—*Preliminary investigation of a new type of supersonic inlet. A. Ferri and L. M. Nucci.*

2287—*An investigation of pure bending in the plastic range when loads are not parallel to a principal plane. H. A. Williams.*

2288—*Estimation of low-speed lift and hinge-moment parameters for full-span trailing-edge flaps on lifting surfaces with and without sweepback. J. B. Dods, Jr.*

2289—*Elastic constants for corrugated-core sandwich plates. C. Libove and R. E. Hubka.*

2290—*A method for calculating stresses in torsion-box covers with cutouts. R. Rosencrans.*

2291—*Influence of wall boundary layer upon the performance of an axial-flow fan rotor. E. Boxer.*

2292—*Experimental investigation of the effects of support interference on the drag of bodies of revolution at a Mach number of 1.5. E. W. Perkins.*

2293—*The physical properties of active nitrogen in low-density flow. J. M. Benson.*

2294—*Lift and pitching derivatives of thin sweptback tapered wings with streamwise tips and subsonic leading edges at supersonic speeds. F. S. Malvestuto, Jr., and Dorothy M. Hoover.*

2296—*Turbulent boundary-layer temperature recovery factors in two-dimensional supersonic flow. M. Tucker and S. H. Maslen.*

2297—*Effect of an increase in angle of dead rise on the hydrodynamic characteristics of a high-length-beam-ratio hull. W. E. Whitaker, Jr. and P. W. Bryce, Jr.*

2298—*A modification to thin-airfoil-section theory, applicable to arbitrary airfoil sections, to account for the effects of thickness on the lift distribution. D. Graham.*

2299—*Exposure tests of galvanised-steel-stitched aluminum alloys.* **F. M. Reinhart.**

2300—*Analytical and experimental investigation of effect of twist on vibrations of cantilever beams.* **A. Mendelson and S. Gendler.**

2301—*Linearized solution and general plastic behaviour of thin plate with circular hole in strain-hardening range.* **M. H. Lee Wu.**

2302—*A general through-flow theory of fluid flow with subsonic or supersonic velocity in turbomachines of arbitrary hub and casing shapes.* **Chung-Hua Wu.**

2303—*Correspondence flows for wings in linearized potential fields at subsonic and supersonic speeds.* **S. M. Harmon.**

2304—*Effect of heat and power extraction on turbo-jet engine performance: IV—analytical determination of effects of hot-gas bleed.* **S. L. Koutz.**

2305—*An analytical and experimental investigation of the skin friction of the turbulent boundary layer on a flat plate at supersonic speeds.* **M. W. Rubesin, R. C. Maydew and S. A. Varga.**

2306—*Meteorological analysis of icing conditions encountered in low-altitude stratiform clouds.* **D. B. Kline and J. A. Walker.**

2307—*A theoretical method of determining the control gearing and time lag necessary for a specified damping of an aircraft equipped with a constant-time-lag autopilot.* **O. B. Gates, Jr. and A. A. Schy.**

2308—*Vibratory stresses in propellers operating in the flow field of a wing-nacelle-fuselage combination.* **V. L. Rogallo, J. C. Roberts and M. R. Oldaker.**

2309—*Charts for estimation of longitudinal-stability derivatives for a helicopter rotor in forward flight.* **K. B. Amer and F. B. Gustafson.**

2310—*Generalization of boundary-layer momentum-integral equations to three-dimensional flows including those of rotating system.* **A. Mager.**

2312—*Bearing strengths of some aluminum-alloy permanent-mold castings.* **E. M. Finley.**

2313—*The effects of mass distribution on the low-speed dynamic lateral stability and control characteristics of a model with a 45° sweptback wing.* **D. E. Hewes.**

2314—*Effect of quadratic terms in differential equations of atmospheric oscillations.* **C. L. Pekeris.**

2315—*Supersonic lift and pitching moment of thin sweptback tapered wings produced by constant vertical acceleration. Subsonic leading edges and supersonic trailing edges.* **F. S. Malvestuto, Jr., and Dorothy M. Hoover.**

2316—*Wind-tunnel investigation at low speed of lateral control characteristics of an untapered 45° sweptback semispan wing of aspect ratio 1.59 equipped with various 25-per cent.-chord plain ailerons.* **H. S. Johnson and J. R. Hagerman.**

2317—*Applications of von Karman's integral method in supersonic wing theory.* **Chieh-Chien Chang.**

2318—*Full-scale-tunnel investigation of the static-thrust performance of a coaxial helicopter rotor.* **R. D. Harrington.**

2319—*Some properties of high-purity sintered wrought molybdenum metal at temperatures up to 2400°F.* **R. A. Long, K. C. Dike and H. R. Bear.**

2320—*Effects of some solution treatments followed by an aging treatment on the life of small cast gas-turbine blades of a cobalt-chromium-base alloy. I—Effect of solution-treating temperature.* **C. Yaker and C. A. Hoffman.**

2321—*Analysis of temperature distribution in liquid-cooled turbine blades.* **J. N. B. Livingood and W. B. Brown.**

2322—*Creep of lead at various temperatures. P. W. Neurath and J. S. Koehler.*

2324—*Fatigue strengths of aircraft materials axial-load fatigue tests on unnotched sheet specimens of 24S-T3 and 75S-T6 aluminum alloys and of SAE 4130 steel. H. J. Grover, S. M. Bishop and L. R. Jackson.*

2325—*Development of magnesium-cerium forged alloys for elevated-temperature service. K. Grube, R. Kaiser, L. W. Eastwood, C. M. Schwartz and H. C. Cross.*

2326—*Two-dimensional subsonic compressible flows past arbitrary bodies by the variational method. Chi-Teh Wang.*

2327—*Fatigue testing machine for applying a sequence of loads of two amplitudes. F. C. Smith, D. M. Howard, Ira Smith and R. Harwell.*

2328—*Method for determining pressure drop of monatomic gases flowing in turbulent motion through constant-area passages with simultaneous friction and heat addition. M. F. Valerino and R. B. Doyle.*

2329—*High-temperature protection of a titanium-carbide ceramal with a ceramic-metal coating having a high chromium content. D. G. Moore, S. G. Benner and W. N. Harrison.*

2330—*Water-landing investigation of a model having heavy beam loadings and 0° angle of dead rise. A. Ethelda McArver.*

2331—*Wind-tunnel investigation of a number of total-pressure tubes at high angles of attack. Subsonic speeds. W. Gracey, W. Letko and W. R. Russell.*

2332—*Analysis of the effects of wing interference on the tail contributions to the rolling derivatives. W. H. Michael, Jr.*

2333—*Transient aerodynamic behavior of an airfoil due to different arbitrary modes of non-stationary motions in a supersonic flow. Chieh-Chien Chang.*

2334—*On reflection of shock waves from boundary layers. H. W. Liepmann, A. Roshko and S. Dhawan.*

2335—*A plan-form parameter for correlating certain aerodynamic characteristics of swept wings. F. W. Diederich.*

2336—*Some theoretical characteristics of trapesoidal wings in supersonic flow and a comparison of several wing-flap combinations. R. O. Piland.*

2337—*Approximate calculation of turbulent boundary-layer development in compressible flow. M. Tucker.*

2338—*Experimental investigation of localised regions of laminar-boundary-layer separation. W. J. Bursnall and L. K. Loftin, Jr.*

2339—*Transonic flow past a wedge profile with detached bow wave; general analytical method and final calculated results. W. G. Vincenti and C. B. Wagoner.*

2340—*A survey of methods for determining stability parameters of an airplane from dynamic flight measurements. H. Greenberg.*

2341—*A least squares curve fitting method with applications to the calculation of stability coefficients from transient-response data. M. Shinbrot.*

2342—*Evaluation of packed distillation columns. 1—Atmospheric pressure. T. W. Reynolds and G. H. Sugimura.*

2343—*Comparison of theoretical and experimental response of a single-mode elastic system in hydrodynamic impact. R. W. Miller and K. F. Merten.*

2344—*Method for calculating downwash field due to lifting surfaces at subsonic and supersonic speeds. S. M. Harmon.*

2345—*The effect of an arbitrary surface-temperature variation along a flat plate on the convective heat transfer in an incompressible turbulent boundary layer. M. W. Rubesin.*

2349—*Fluctuations in a spray formed by two impinging jets. M. F. Heidmann and J. C. Humphrey.*

2350—*On the second-order tunnel-wall-constriction corrections in two-dimensional compressible flow. E. B. Klunker and K. C. Harder.*

2351—*An experimental investigation of the effect of surface heating on boundary-layer transition on a flat plate in supersonic flow. R. W. Higgins and C. C. Pappas.*

2352—*Spin-tunnel investigation of the effects of mass and dimensional variations on the spinning characteristics of a low-wing single-vertical-tail model typical of personal-owner airplanes. W. J. Klinar and J. H. Wilson.*

2354—*A numerical approach to the instability problem of monocoque cylinders. B. A. Boley, J. Kempner and J. Mayers.*

2355—*Achromatization of Debye-Scherrer lines. H. Ekstein and S. Siegel.*

2360—*Effect of tail surfaces on the base drag of a body of revolution at Mach numbers of 1·5 and 2·0. J. R. Spahr and R. R. Dickey.*

Civil Aeronautics Administration. Technical Development Reports

129—*The practical determination of strength of doped fabric. H. Kendall King, C. B. Phillips and A. L. Morse.*

134—*An investigation of the crash-fire problems in transport aircraft fuel tanks. R. L. Field, M. F. Miller and G. L. Pigman.*

Garbell Aeronautical Series

No. 1—*Recent developments in visual low-approach and landing aids for aircraft. M. A. Garbell.*

No. 2—*A new system of surface markings for aircraft runways. M. A. Garbell.*

No. 3—*The ground run of aircraft in landing and take-off. M. A. Garbell and W. M. Young.*

A. M. BALLANTYNE,
Secretary.

THE ROYAL AERONAUTICAL SOCIETY
4 Hamilton Place, Piccadilly, London, W.1. Tel.: Grosvenor 3515-19

THE LEWES PRESS (Wightman & Co. Ltd.), Friars Walk, Lewes, Sussex

SECRETARY'S NEWS LETTER

FOR SEPTEMBER 1951

SEVENTH BRITISH COMMONWEALTH AND EMPIRE LECTURE

The Seventh British Commonwealth and Empire Lecture will be given at the Institution of Civil Engineers, Great George Street, S.W.1, on 4th October 1951 at 6 p.m. The lecture will be given by Sir Leonard Isitt, K.B.E., of New Zealand, on "Air Transport in New Zealand and the South Pacific."

Tea will be served at 5.30 p.m.

THE GOLD MEDAL OF THE F.A.I.

The Gold Medal of the Federation Aéronautique Internationale has been awarded to Air Commodore Sir Frank Whittle, K.B.E., C.B., C.B.E., M.A., D.Sc., F.R.S., F.R.Ae.S.

THE DANIEL GUGGENHEIM MEDAL

Mr. Igor Sikorsky has been awarded the Daniel Guggenheim Medal and certificate for 1951 "for a lifetime of outstanding contributions to aeronautics, including pioneering with multi-engine aeroplanes, flying boats, amphibians and helicopters."

MEMBERS' NEW APPOINTMENTS

D. L. Hollis Williams, B.Sc. (*Fellow*)—Chief Engineer, Westland Aircraft Ltd.

Wing Commander H. P. Powell, D.F.C. (*Associate*)—Lockheed Hydraulic Brake Co. Ltd.

Norman Green (*Associate Fellow*)—Chief Technician at Acton Branch of English Electric Ltd., Aircraft Division.

F. O. Fox (*Companion*)—Engineering Assistant, Khartum Technical College.

SOCIETY STAFF REQUIREMENTS

Applications are invited for the posts of senior technicians to guide and take part in the preparation of the Society's Data Sheets, particularly those on Aerodynamics and Structures.

Applicants should have had experience in the abstraction and use of experimental, test and theoretical information from official and other sources.

Salaries will be on a scale comparable to those for Senior Scientific Officers, £700 × £25 to £900.

Applications must be made in writing to the Secretary and marked *Confidential*.

There is also a vacancy for a draughtswoman-tracer on the Technical Staff of the Society.

CONTENTS OF THE SEPTEMBER JOURNAL

Some Aspects of Modern Naval Aircraft Design, D. L. Hollis Williams, B.Sc., F.R.Ae.S.

Air Transport from the Passenger's Point of View—a Discussion.

The Derivation and Estimation of Aerodynamic Loads for Stressing Purposes, D. J. Lambert, A.F.R.Ae.S., A.M.I.Mech.E.

Nose-Wheel Steering Systems, H. G. Conway, F.R.Ae.S.

Reviews.

The Council are particularly anxious to encourage members of the Society to support their own Journal by contributions to it of articles and papers on any aspect of Aeronautics. For that purpose they have set aside £250 a year in the form of premium awards to the authors (members or non-members) of such papers as some reimbursement for the work which has been done by the author. These premium awards are not fixed but vary from five to twenty guineas normally. It is hoped therefore that those members who have written papers on their special subjects will consider their own Journal in the first place.

THE AERONAUTICAL QUARTERLY—Part II, Volume III

Part II, Volume III of the Aeronautical Quarterly will be available towards the end of September. The Contents of Part II, Volume III are:—

The Construction and Testing of a Xylonite Model of a Delta Aircraft	S. C. Redshaw and P. J. Palmer
A Note on the Stressing of Oleo-Pneumatic Shock Absorbers	D. M. A. Leggett
The Anti-Symmetric Vibrations of Aircraft	R. W. Traill-Nash
The Flow of an Incompressible Fluid through an Axial Turbo-Machine with any Number of Rows	J. W. Railly

Copies of Volume III, Part I, of "The Aeronautical Quarterly" are still available from the offices of the Society at 7s. 9d. a copy to members of the Society, post-paid, or 10s. 3d. to non-members, post-paid.

The contents of Part I, Volume III, are:—

The Symmetric Vibrations of Aircraft	R. W. Traill-Nash
Airscrews at Supersonic Forward Speeds	J. C. Burns
Polhausen's Method for Three - Dimensional Laminar Boundary Layers	J. C. Cooke
Supersonic Flow Past Bodies of Revolution with Thin Wings	P. M. Stocker

Copies of Volume II, Parts I to IV and a few copies of Volume I, Parts I to IV are still available, but members are reminded that a strictly limited edition only of "The Aeronautical Quarterly" is printed and numbers cannot be reprinted in any circumstances. An annual subscription to Volume III therefore is advisable.

MEDALS AND AWARDS

The following medals and prizes have been awarded by the Council of the Society:—

The Society's Gold Medal

The highest honour which the Society can confer for work of an outstanding nature in Aeronautics, to:

W. G. A. Perring (posthumously) in recognition of his distinguished service to aeronautical science.

The Society's Silver Medal

Awarded for work of an outstanding nature in Aeronautics, to:

S. B. Gates for outstanding work on the stability and control of aircraft.

The Society's Bronze Medal

Awarded for work leading to advances in Aeronautics, to:

H. J. Pollard for his many contributions to the development of aircraft construction.

The British Gold Medal

Awarded for practical achievement leading to advancement in Aeronautics, to:

A. E. Russell for practical achievement in aircraft design.

The British Silver Medal

Awarded for practical achievement leading to advancement in Aeronautics, to:

Group Captain J. Cunningham for his outstanding achievements as a test pilot.

The R. P. Alston Memorial Prize

Awarded for practical achievement associated with the flight testing of aircraft, to:

R. J. Falk for his outstanding work in the testing of British Delta Wing aircraft.

The George Taylor (of Australia) Gold Medal

Awarded annually, at the discretion of the Council for the most valuable paper read during the previous session, to:

R. E. Bishop for his paper on Design for Maintenance (August 1950 JOURNAL).

The Simms Gold Medal

Awarded annually at the discretion of the Council for the most valuable contribution read before, or received by, the Society on any subject allied to aeronautics, *e.g.* structures, meteorology, metrology, etc., to:

Dr. G. S. Hislop for his paper on Clear Air Turbulence Over Europe (April 1951 JOURNAL).

The Herbert Ackroyd Stuart Memorial Prize

Awarded at the discretion of the Council for the most valuable contribution read before, or received by, the Society on Applied Thermodynamics, to:

A. V. Cleaver for his paper on Rockets and Assisted Take-Off (February 1951 JOURNAL).

The Edward Busk Memorial Prize

Awarded annually at the discretion of the Council for the most valuable contribution read before, or received by, the Society on Applied Aerodynamics, to:

R. Hills for his paper on The Use of Wind Tunnel Model Data in Aerodynamic Design (January 1951 JOURNAL).

The Orville Wright Prize

Dr. Neumark for his paper on Swept Back Wings, published in *The Aeronautical Quarterly*, August 1950.

These Medals and Prizes were presented to the recipients at the 39th Wilbur Wright Memorial Lecture at the Royal Institution, 21 Albemarle Street, London W.1, on 10th September 1951, when Mr. A. E. Raymond, of the Douglas Aircraft Corporation, lectured on The Well-Tempered Aircraft.

JOURNAL PREMIUM AWARDS

The following Premium Awards have been made in 1951 for papers published in the JOURNAL during 1950:—

H. L. Cox and E. P. Coleman for their paper on Note on Repeated Loading Tests on Components and Complete Structures, Fifteen Guineas. January 1950 JOURNAL.

Dr. P. B. Walker for his paper on Destructive Energy in Aircraft Pressure Cabins, Fifteen Guineas. April 1950 JOURNAL.

D. R. H. Dickinson for his paper on Prototype Testing of Aircraft, Fifteen Guineas. June 1950 JOURNAL.

C. H. Latimer-Needham for his paper on Flight Refuelling and the Problem of Range, Fifteen Guineas. July 1950 JOURNAL.

W. E. Thornton-Bryar for his paper on Elementary Aspects of Technical Statistics and Common Fallacies—with Examples on Measurement of Aero Engine Reliability, Fifteen Guineas. July 1950 JOURNAL.

Professor A. D. Young for his paper on The Drag Effects of Roughness at High Subcritical Speeds, Fifteen Guineas. August 1950 JOURNAL.

C. H. Jackson for his paper on Some Aspects of Air Safety, Fifteen Guineas. September 1950 JOURNAL.

C. J. Moss for his paper on Redux Bonding of Aircraft Structures, Fifteen Guineas. October 1950 JOURNAL.

S. C. Ghose for his paper on A Comparative Study of the Noise from Turbo-Jet and Reciprocating Aircraft Engines in Flight, Fifteen Guineas. November 1950 JOURNAL.

H. Giddings for his paper on Aircraft Riveting, Fifteen Guineas. December 1950 JOURNAL.

MAIN LECTURES—AUTUMN SESSION 1951

(At 6 p.m. in the Lecture Hall of the Institution of Civil Engineers, Great George Street, London, S.W.1, unless otherwise stated. Tea will be served at 5.30 p.m.)

Thursday, 18th October 1951—Modern Trends in Civil Airworthiness Requirements, W. Tye, O.B.E., F.R.Ae.S.

Thursday, 1st November 1951—Films associated with Mr. E. G. Stout's lecture to the Third Anglo-American Conference on A Review of High-Speed Hydrodynamic Development. These films are sound films and the showing will take just over one hour.

Thursday, 22nd November 1951—AT CHELTENHAM—Problems of Transonic Flight, A. N. Clifton, F.R.Ae.S., at St. Mary's College, at 7.30 p.m.

Thursday, 29th November 1951—Structural Problems in Advanced Aircraft, H. H. Gardner, F.R.Ae.S.

Thursday, 6th December 1951—Air Intakes for Gas Turbines, J. Seddon.

Thursday, 20th December 1951—Control Surface Flutter, H. G. Broadbent, A.F.R.Ae.S., and W. T. Kirkby.

SECTION LECTURES

(At 7 p.m. in the Library of the Royal Aeronautical Society, 4 Hamilton Place, London, W.1, unless otherwise stated.)

Tuesday, 9th October 1951—Power Operated Controls, C. F. Joy, A.F.R.Ae.S.

Tuesday, 30th October 1951—Supersonic Propellers, Dr. W. F. Hilton, A.F.R.Ae.S.

Tuesday, 27th November 1951—Is it possible to simplify Aircraft and still Maintain their Efficiency? W. S. Farren, F.R.Ae.S.

GRADUATES' AND STUDENTS' SECTION

LECTURES

(At 7.30 p.m. in the Library of the Royal Aeronautical Society, 4 Hamilton Place, London, W.1, unless otherwise stated.)

Thursday, 11th October 1951—Airships, Lord Ventry.

Thursday, 25th October 1951—The A.B.C. of Stability, K. S. Lawson (Student).

Tuesday, 6th November 1951—Design Costing, Mr. Bunnett.

RECEPTION

The Graduates' and Students' Section will hold a Reception and Dance at the Society at 7.30 p.m. on Friday, 9th November 1951, to which all members of the Section and their ladies are invited.

Applications for tickets, price 7/6 double or 4/- single, which includes light refreshments, should be sent with remittance to Mr. J. Roxburgh, 45 Fitzjohn's Avenue, N.W.3.

BRANCH NOTICES

BRISTOL BRANCH

Wednesday, 24th October 1951—Civil Aviation; its Present and Future, Peter G. Masefield, M.A., F.R.Ae.S.

In the Conference Room, Filton House at 6 p.m.

COVENTRY BRANCH

Wednesday, 17th October 1951—Modern Methods of Testing Aero Engines, L. B. Hall.

Wednesday, 21st November 1951—The Problems of Integrally Stiffened Wing Structures, A. F. Newall, A.F.R.Ae.S.
Wednesday, 19th December 1951—Film Evening.
In the Wine Lodge (Corner of Corporation Street and The Burges) at 7.30 p.m.

DERBY BRANCH
Monday, 1st October 1951—Astro-Physics in Relation to Space Travel, Fred Hoyle. Tickets can be obtained from the Secretary, C. Ainsworth Davis, B.Sc., A.F.R.Ae.S.
Monday, 5th November 1951—The Princess, H. Knowler, A.M.Inst.C.E., F.R.Ae.S.
Monday, 3rd December 1951—The Aviation Engine, Air Commodore F. R. Banks, C.B., O.B.E., F.R.Ae.S.
In the Rolls-Royce Welfare Hall, Nightingale Road, at 6.15 p.m.

ELECTIONS

The following is a list of new members and transfers of membership of the Society:—

Associate Fellows

Harold Billett
Stanley Kenneth Harley (from Graduate)
Gordon Jefferson (from Graduate)
Harry Usher Midwood (from Graduate)
William Irving Stieglitz
Alexander Ernest Sutherland

Associates

Frederick James Edwards (from Graduate)
Denis McManus
Arthur Robert Moore
Caesar B. Pattarini
George Wood

Graduates

Lawrence George Evans
Peter Francis Locker Hall
John Frederick Jones (from Student)

JOURNAL BINDING

The prices of binding of Journals are as follows:—
1950 Volume (including packing and postage), 16s. 0d.
Previous Volumes (including packing and postage), 18s. 0d.

Journals, with a note of the name and address of the sender, should be sent direct to The Lewes Press, Friars Walk, Lewes, Sussex, and the remittance to the Secretary at the offices of the Society.

Cases only for unbound 1950 Volumes are available, price 6s. 6d. each. Requests for cases, with remittances, should be sent to the Secretary at the offices of the Society.

CHANGES OF ADDRESS

To assist in keeping the records of members correct and up to date the Secretary will be glad if all members will notify him as soon as possible of changes of address.

When notifying changes please give the following particulars:—
Name (in block letters).
Grade of membership.
New address (in block letters).
Old address.

Changes of address must be received *before the 15th of the month* in order to be effective for the Journal for the following month.

ACKNOWLEDGMENTS

The Council acknowledge with grateful thanks the gift of papers and pamphlets on Aviation Medicine from Dr. K. G. Bergin, *Associate Fellow*; and the return of back numbers of the JOURNAL from B. Kaiser, Esq., *Associate Fellow*, and E. C. Gibbons, Esq., *Associate Fellow*.

ADDITIONS TO THE LIBRARY

The following have been added to the Library (titles of pamphlets are printed in italics. Books marked * or ** may not be taken out on loan):—

*Aeronautical Research Committee	Technical Reports for 1940 and 1941. H.M.S.O. 1950 and 1951.
Binder, R. C.	Advanced Fluid Dynamics and Fluid Machinery. Prentice-Hall. 1951.
*British Standards Institution	Yearbook. British Standards Institution. 1951.
*British Standards Institution	Wrought Aluminium and Aluminium Alloys. Bars, Rods, Sections. B.S. 1476 : 1949. British Standards Institution. 1949.
Elbourne, E. T.	Fundamentals of Industrial Administration. 2 volumes. 4th edition. MacDonald & Evans. 1948/9.
Fradkin, E. K.	A World Airlift: The United Nations Air Police Patrol. Funk & Wagnall. 1950.
Frost, M. G.	Teach Yourself Management. English Universities Press. 1951.
Inglis, Sir Charles	Applied Mechanics for Engineers. Cambridge University Press. 1951.
Ladoo, R. B. and Myers, W. M.	Nonmetallic Minerals. 2nd edition. McGraw-Hill. 1951.
Langhaar, H. L.	Dimensional Analysis and Theory of Models. Chapman & Hall. 1951.
Marton, L. (Editor)	Advances in Electronics. Volume III. Academic Press. 1951.
Murrell, C. E.	From the Pilot's Seat. An Airman's View of England and Wales. Chapman & Hall. 1950.
Nenadovic, M.	Osnovi Aerodinamickih Konstrukcija: Prilog. Belgrade. 1950.
Nenadovic, M.	Osnovi Aerodinamickih Konstrukcija: Prvi Deo. Belgrade. 1950.
Schlichting, H.	Grenzschicht—Theorie. G. Braun, Karlsruhe. 1951.
Singer, F. L.	Strength of Materials. Harper & Bros. 1951.
Timoshenko, S. and Young, D. H.	Engineering Mechanics. 3rd edition. McGraw-Hill. 1951.
Walther, A.	The American Fiat Review of German Science 1939-1946. M. H. Davidson Co. 1950.
*Wilkinson, P. H.	Aircraft Engines of the World. Wilkinson. 1951.

A.R.C. Current Papers

42—*Wind tunnel tests on the effect of accretion of ice on control characteristics in two-dimensional flow. A. S. Halliday, A. S. Batson and Miss D. K. Cox.*

43—*Further wind tunnel tests on the effects of ice accretion on control characteristics. A. Spence.*

44—*A recording system for flight test data. P. A. Hufton, F. G. R. Cook and P. S. Saunders.*

45—*Comparison between experimental measurements and a suggested formula for the variation of turbulent skin-friction in compressible flow. R. J. Monaghan.*

46—*A note on the use of time series in the analysis of flight test series. W. P. Jones.*

Aeronautical Research Laboratories, Australia

Aerodynamics Note 100—*Tests of Williams Glas II profile using a two-dimensional three-foot chord model. T. S. Keeble and P. B. Atkins.*

Report S.M.169—*The constitutional diagram of the chromium-tungsten system. H. T. Greenaway.*

Ministère de l'air, France. Publications scientifiques et techniques

No. 249—*Jets gazeux sensibles aux sons et aux ultra-sons. M. Dubois.*

National Luchtvaartlaboratorium, Amsterdam

Report F.16—*The direct and the inverse problem of aerofoil theory. A method, to obtain numerical solutions. R. Timman.*

Report F.66—*A calculation method for three-dimensional laminar boundary layers. R. Timman.*

National Advisory Committee for Aeronautics, U.S.A.

Thirty-sixth annual report of the National Advisory Committee for Aeronautics. 1590.

Reports

990—*An analysis of supersonic aerodynamic heating with continuous fluid injection. E. B. Klunker and H. Reese Ivey.*

991—*The application of the statistical theory of extreme values to gust-load problems. H. Press.*

992—*Theoretical comparison of several methods of thrust augmentation for turbo-jet engines. E. W. Hall and E. C. Wilcox.*

993—*An introduction to the physical aspects of helicopter stability. A. Gessow and K. B. Amer.*

***Technical Memoranda**

12 58—*Flight performance of a jet power plant. III—Operating characteristics of a jet power plant as a function of altitude. F. Weinig.*

1281—*Unstable capillary waves on surface of separation of two viscous fluids. V. A. Borodin and Y. F. Dityakin.*

1283—*Resistance of a delta wing in a supersonic flow. E. A. Karpovich and F. I. Frankl.*

1305—*On ionization and luminescence in flames. E. Sanger, P. Goercke and I. Bredt.*

***Technical Notes**

2346—*An iterative transformation procedure for numerical solution of flutter and similar characteristics-value problems. M. L. Gossard.*

2347—*Effect of aspect ratio and sweepback on the low-speed lateral control characteristics of untapered low-aspect-ratio wings equipped with retractable ailerons. J. Fischel and J. R. Hagerman.*

2348—*Effect of aspect ratio on the low-speed lateral control characteristics of unswept untapered low-aspect-ratio wings. R. L. Naeseth and W. M. O'Hare.*

2353—*Charts and tables for use in calculations of downwash of wings of arbitrary plan form. F. W. Diederich.*

2356—*Two-dimensional transonic flow past airfoils. Yung-Huai Kuo.*

2357—*Method for calculation of ram-jet performance. J. R. Henry and J. B. Bennett.*

2358—*Effect of vertical-tail area and length on the yawing stability characteristics of a model having a 45° sweptback wing. W. Letko.*

2359—*Floating characteristics of a plain and a horn-balanced rudder at spinning attitudes as determined from rotary tests on a model of a typical low-wing personal-owner aeroplane. W. Bihrle, Jr.*

2361—*Turbulence-intensity measurements in a jet of air issuing from a long tube. B. H. Little, Jr., and S. W. Wilbur.*

2362—*Torsional strength of stiffened D-tubes. E. S. Kavanaugh and W. D. Drinkwater.*

2363—*On the application of Mathieu functions in the theory of subsonic compressible flow past oscillating airfoils. E. Reissner.*

2364—*On two-dimensional flow after a curved stationary shock (with special reference to the problem of detached shock waves). S. S. Shu.*

2365—*Analytical evaluation of aerodynamic characteristics of turbines with non-twisted rotor blades. W. R. Slivka and D. H. Silvern.*

2366—*Friction at high sliding velocities of oxide films on steel surfaces boundary-lubricated with stearic-acid solutions. R. L. Johnson, M. B. Peterson and M. A. Swikert.*

2367—*General plastic behaviour and approximate solutions of rotating disk in strain-hardening range. M. H. Lee Wu.*

2369—*Torsion and transverse bending of cantilever plates. E. Reissner and M. Stein.*

2370—*Matrix method of determining the longitudinal-stability coefficients and frequency response of an aircraft from transient flight data. J. J. Donegan and H. A. Pearson.*

A. M. BALLANTYNE, T.D., Ph.D., A.F.R.Ae.S.,
Secretary.

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THE LEWES PRESS (Wightman & Co. Ltd.), Friars Walk, Lewes, Sussex.

SECRETARY'S NEWS LETTER

OCTOBER 1951

AT THE INVITATION of Mr. G. H. Dowty, the President of the Gloucester and Cheltenham Branch, I attended the first lecture of the Autumn Session of the Branch, and when he suggested that I should say a few words I asked him "about what?" He replied, "Anything. Merely say 'hullo.'"

On thinking over this small incident, I realise that I have not yet said "hullo" to the majority of the Society Members, so I am saying it now and hope to do so in the near future, in person, to many of the members, especially at Branch Meetings.

President Roosevelt, I think it was, who held "Fireside Chats"; there is also a newspaper feature, entitled "Something I want to say." In future, part of this News Letter will comprise a somewhat similar feature, written by the Secretary. In it I shall give personal opinions and experiences concerning the activities of the Society and "talk of many things."

I should like to give my impressions of the Anglo-American Aeronautical Conference at Brighton. I, as do many others, think that the Conference was a great success. Quite literally I enjoyed it. "Veni, vidi, victus sum," "I came, I saw, I was conquered" by the friendliness of everyone, whether belonging to the I.A.S. or the R.Ae.S. The way to Anglo-American co-operation may be long, but the wind is certainly not cold.

In the November issue of the JOURNAL there will be a full account of the Conference, but there is one fact which it will not record—the passing of a legend. The legend that the Englishman—I use the noun advisedly—is staid and proper, has been destroyed, for after the dances at the Royal Pavilion and the Grand Hotel no American who was present will ever give any credence to this fairy tale.

Immediately after the Reception which followed the Wilbur Wright Memorial Lecture on 10th September, Major F. B. Halford, President of the Society, underwent an operation on his throat. The operation was successful, but unfortunately has not achieved a complete cure and the President is now faced with a period of treatment for five or six weeks. He knows that we all wish him a very speedy recovery.

At Brighton the President did not spare himself in doing those things he thought he ought to do, although each Vice-President in turn offered to relieve him of them. Obstinately he refused all offers; he was adamant that he could do everything himself. He did!

"What do they know of England, who only Scotland know?"

I realise the truth of this misquotation, and I hope it will soon be changed to "much have I travelled in the realm," for I intend to visit the Branches and the Aircraft firms.

I made my first visit to a Branch when I visited Cheltenham on 18th September. This was the occasion of the lecture by Mr. Preston R. Bassett, President of the Sperry Gyroscope Company of America. It was an interesting and amusing lecture given to a large and appreciative audience of close on 200 Branch members and friends. I was informed that most of the staff of Smith's Instruments were present, but had they hopes of inside information concerning the Sperry products, they must have gone their way near to lamenting.

Before the lecture the President of the Branch gave a Dinner to the Lecturer, the Branch Officers and a number of guests—a most pleasant occasion.

During this Autumn Session of 1951 the Gloucester and Cheltenham Branch celebrates its coming of age, and to mark the occasion the Branch Secretary has produced a small booklet giving both a history of the Branch and a résumé of the history of the firms which support it.

The Gloucester and Cheltenham Branch was formed on 14th November 1930, with Mr. H. P. Folland, at that time Chief Designer of the Gloster Aircraft Company, as Chairman and Mr. L. W. Nethercott as Secretary. Membership was drawn from the Gloster Aircraft Company which, in 1930, was the only aeronautical firm in the district. The first lecture was given by Mr. G. R. (now Sir Richard) Fairey in the Cheltenham Library and was attended by more than 180 people. Before long, lectures, which were held approximately once a month, were given alternately in Cheltenham and in Gloucester, a practice which still continues. Early in its history the Branch was presented with a film projector by Mr. David Longden (Managing Director of Gloster Aircraft Company) during his term of office as President. There were then about 80 members of the Branch.

During the 1939-45 War, the Branch activities became dormant, but in September 1946 the Branch was revived. Since the formation of the Branch other aeronautical firms had become established in the district, first Dowty Equipment Ltd., then Rotol Ltd. in 1937, and later on they were joined by Smiths Aircraft Instruments Ltd., and in 1947 by British Messier Ltd. Since 1946 the Branch has gone from strength to strength and in addition to lectures and films, visits are now arranged by the Branch not only to such annual affairs as the Society's Garden Party and the S.B.A.C. Show, but to local aeronautical firms. The Branch continues to prosper and now has more than 350 members. It is fortunate in the support and co-operation which it receives from the local firms from which it draws most of its membership.

The day after Mr. Bassett's Lecture, before returning to London, I made an interesting tour of the works of Dowty Equipment Ltd., but unfortunately had not time to visit any of the other firms in the district. I hope to do that later, perhaps when the main Society Lecture is given at Cheltenham on 22nd November—a date which almost coincides with the 21st Anniversary of the Gloucester and Cheltenham Branch.

One of the youngest Branches of the Society—the Halton Branch—suffered a great loss this summer in the sudden death of Wing Commander L. A. W. Deane. He died while following one of his favourite hobbies, climbing on Snowdon. On Sunday 30th September, I attended the Memorial Service which was held for him at St. George's Church, R.A.F. Station, Halton. The lesson was read by the Commandant, Air Commodore J. G. Elton, and a moving address was given by the Chaplain, the Rev. B. Knight. Affectionately known as "Dizzy" to his many friends both in and out of the Service, Wing Commander Deane was the Founder and Chairman of the Halton Branch of the Society.

On Tuesday 11th September, at the kind invitation of the S.B.A.C., I was present at the S.B.A.C. Dinner at the Dorchester. The number of guests at this Dinner ran into four figures. Another enjoyable function.

On the following day I went to the S.B.A.C. Show at Farnborough. I was standing on a chair and almost fell off trying to take a ciné film of the Hawker P1067. I can truthfully say that it was the best S.B.A.C. Show I have ever attended: it was my first.

One of the visits arranged for the Americans after the Third Anglo-American Aeronautical Conference was to Vickers-Armstrongs Ltd. at Weybridge. On the invitation of Mr. G. R. Edwards, some of the members of the staff also attended. To their vocal delight they were given a flight in the Viscount; it was a delightful touch to see Brighton from the air.

Before I conclude I must say something, on behalf of us all, to Captain J. Laurence Pritchard. It is not "goodbye"! Rather let "good-bye" be expanded again to its original form—

"God be with you."

Secretary

NOTICES

CONTENTS OF THE OCTOBER JOURNAL

The Thirty-ninth Wilbur Wright Memorial Lecture—The Well-Tempered Aircraft, A. E. Raymond.

High-speed Flying, John D. Derry.

Power Plants for High-Speed Flying, A. D. Baxter.

Reviews.

The Council are particularly anxious to encourage members of the Society to support their own Journal by contributions to it of articles and papers on any aspect of Aeronautics. For that purpose they have set aside £250 a year in the form of premium awards to the authors (members or non-members) of such papers as some reimbursement for their work. These premium awards are not fixed but vary from five to twenty guineas normally. It is hoped that those members who have written papers on their special subjects will consider their own Journal in the first place.

THE AERONAUTICAL QUARTERLY—Volume III, Part II

Part II, Volume of the Aeronautical Quarterly is now available. The Contents of Part II, Volume III are:—

The Construction and Testing of a Xylonite Model of a Delta Aircraft	S. C. Redshaw and P. J. Palmer
A Note on the Stressing of Oleo-Pneumatic Shock Absorbers	D. M. A. Leggett
The Anti-Symmetric Vibrations of Aircraft	R. W. Traill-Nash
The Flow of an Incompressible Fluid through an Axial Turbo-Machine with any Number of Rows	J. W. Railly

Copies of Volume III, Part I, of "The Aeronautical Quarterly" are still available from the offices of the Society at 7s. 9d. a copy to members of the Society, post-paid, or 10s. 3d. to non-members, post-paid.

The contents of Part I, Volume III, are:—

The Symmetric Vibrations of Aircraft	R. W. Traill-Nash
Airscrews at Supersonic Forward Speeds	J. C. Burns
Polhausen's Method for Three - Dimensional Laminar Boundary Layers	J. C. Cooke
Supersonic Flow Past Bodies of Revolution with Thin Wings	P. M. Stocker

Copies of Volume II, Parts I to IV and a few copies of Volume I, Parts I to IV are still available, but members are reminded that a strictly limited edition only of "The Aeronautical Quartely" is printed.

MEMBERS' NEW APPOINTMENTS

SIR HENRY TIZARD, G.C.B., A.F.C., F.R.S., *Honorary Fellow*, who is to retire in March next after nearly six years as Chairman of the Advisory Council on Scientific Policy, has been appointed to the National Research Development Corporation. This Corporation was established in 1949 to develop inventions in the public interest.

R. N. DOREY, O.B.E., B.Sc., *Fellow*, has been appointed General Manager of the Car Division of Rolls-Royce Ltd., and Deputy to Dr. Llewellyn Smith, a Director of Rolls-Royce Ltd. and Chief Executive of the Car Division. Mr. Dorey was formerly Manager of the Power Plant and Flight Development Division.

F. M. OWNER, C.B.E., M.Sc., M.I.Mech.E., *Fellow*, has joined the de Havilland Engine Co. Ltd. as Deputy Chief Engineer. He retired from the post of Chief Engineer (Engines) Bristol Aeroplane Co. Ltd. in July.

J. W. TRURAN, A.F.C., *Associate*, has been appointed Special Projects Engineer, Bristol Aeroplane Co. of Canada Ltd. He was formerly in charge of transport aircraft and pilotless targets with the Ministry of Supply.

A. E. FISHLOCKE, *Associate Fellow*, has been transferred to the Inspection of Fighting Vehicles, Aeronautical Inspection Directorate. He was formerly Inspector in Charge, A.I.D., at Armstrong Siddeley Motors Ltd.

AMENDMENT

In the September "Secretary's News Letter," the appointment of Mr. Norman Green to English Electric Co. Ltd. was announced. This should, of course, have read Norman Geen. In the same issue Mr. Fox, who has been appointed to Khartum Technical College, was given the initial N. whereas his initials should have been F. O.

C. AINSWORTH DAVIS

It is with great regret that we have learned of the death of C. Ainsworth Davis, B.Sc., *Associate Fellow*, on 1st October, at the early age of 42. Mr. Davis joined Rolls-Royce Ltd. 17 years ago and was connected with the design of the Merlin and Griffin piston engines and from 1942 on, with the Company's gas turbine engines. For the past ten months he had been Deputy Chief Designer (Projects).

Mr. Davis was an active member of the Derby Branch of the Society and at the time of his death was Secretary of the Branch. His loss will be felt not only by Rolls-Royce Ltd., but by the Derby Branch and the Society.

ELLIOTT MEMORIAL PRIZE

The Elliott Memorial Prize has been awarded to Sergeant Aircraft Apprentice R. Greenwood, of the January 1949 Entry at R.A.F. Halton, who has obtained the highest marks in the General Studies Examination. The prize will be presented to him at the Graduation Prize Giving on 18th December 1951.

CIERVA MEMORIAL PRIZE ESSAY 1951-52

The Cierva Memorial Prize, of £25, awarded annually by the Helicopter Association of Great Britain, will be awarded for 1952 for the best original paper of a technical nature on any subject connected with rotating wing aircraft. Papers which are purely historical or journalistic will not be eligible but the subject may be taken broadly to include studies in any related field, such as operational, administrative, maintenance, navigation, safety and economics, as well as the more conventional fields of aeronautical science and engineering.

Competitors should be less than 35 years of age on 31st December 1951. Entries for 1951-52 must be received by 31st March 1952.

Particulars of the competition may be obtained from the Secretary, the Helicopter Association of Great Britain, Londonderry House, 19 Park Lane, London, W.1.

TECHNICAL INFORMATION

A meeting of librarians and information officers connected with aeronautics was held at the Royal Aircraft Establishment, Farnborough, on 27th September, under the sponsorship of ASLIB (Association of Special Libraries Information Bureaux), to form an Aeronautical Engineering Group.

The following Committee was formed to control the work of the Group:—

R. G. Thorne (Royal Aircraft Establishment), *Chairman*
C. W. Cleverdon (College of Aeronautics), *Secretary*
A. R. Cameron (A. V. Roe & Co. Ltd.)
T. G. Dickson (Rolls-Royce Ltd.)
A. H. Holloway (Ministry of Supply)
J. A. Kirk (Short Brothers & Harland Ltd.)
Mrs. M. Neal (*Engineering*)
F. H. Smith (Royal Aeronautical Society)
P. S. Walkins (British European Airways)

Working parties have been formed to consider Abstract Services, Classification of Data (with emphasis on Aerodynamics) and a Union Catalogue of Periodicals.

Suggestions for consideration by the group should be sent to the Secretary, C. W. Cleverdon, at the College of Aeronautics, or to members of the Committee.

COMMONWEALTH FUND OF NEW YORK FELLOWSHIPS

Twenty Fellowships are offered in 1952 by the Commonwealth Fund of New York to men and women who are British Subjects, not normally resident in or near the Americas, and who are degree graduates of a University in the United Kingdom of Great Britain and Northern Ireland. Candidates may be married or single but should be over 23, and under 35, years of age on 1st September of the year of award. No one is eligible who has already worked or studied in the United States for more than a few months. Ordinary Fellowships are tenable for 12 months. The closing date for applications is 31st December 1951.

In addition there are five other categories of Fellowships.

Full particulars of all Fellowships and application forms may be obtained from the Warden, Harkness House, 35 Portman Square, London, W.1.

MAIN LECTURES—AUTUMN SESSION 1951

(At 6 p.m. in the Lecture Hall of the Institution of Civil Engineers, Great George Street, London, S.W.1, unless otherwise stated. Tea will be served at 5.30 p.m.)

Thursday, 1st November 1951—FILMS—associated with Mr. E. G. Stout's lecture to the Third Anglo-American Conference on A Review of High-Speed Hydrodynamic Development. These films are sound films and the showing will take just over one hour.

Thursday, 22nd November 1951—AT CHELTENHAM—Problems of Transonic Flight, A. N. Clifton, F.R.Ae.S. **At St. Mary's College, at 7.30 p.m.**

Thursday, 29th November 1951—Structural Problems in Advanced Aircraft, H. H. Gardner, F.R.Ae.S.

Thursday, 6th December 1951—Air Intakes for Gas Turbines, J. Seddon, A.F.R.Ae.S.

Thursday, 20th December 1951—Control Surface Flutter, E. G. Broadbent, A.F.R.Ae.S., and W. T. Kirkby, A.F.R.Ae.S.

SECTION LECTURES

(*At 7 p.m. in the Library of the Royal Aeronautical Society, 4 Hamilton Place, London, W.1, unless otherwise stated.*)

Tuesday, 23rd October 1951—Some Aspects of Aircraft Design and Manufacture for Limited Production, W. S. Hollyhock, A.F.R.Ae.S.

Tuesday, 30th October 1951—Supersonic Propellers, Dr. W. F. Hilton, A.F.R.Ae.S.

Tuesday, 27th November 1951—Is It Possible to Simplify Aircraft and Still Maintain their Efficiency? W. S. Farren, F.R.Ae.S.

GRADUATES' AND STUDENTS' SECTION

LECTURES

(*At 7.30 p.m. in the Library of the Royal Aeronautical Society, 4 Hamilton Place, London, W.1, unless otherwise stated.*)

Thursday, 25th October 1951—The A.B.C. of Stability, K. S. Lawson (Graduate).

Tuesday, 6th November 1951—Production Research for Aircraft, L. E. Bunnett, A.F.R.Ae.S.

Tuesday, 11th December 1951—Naval Aircraft, D. L. Hollis Williams, F.R.Ae.S.

BRANCH NOTICES

BRISTOL BRANCH

Wednesday, 24th October 1951—Civil Aviation: its Present and Future, Peter G. Masefield, M.A.(Eng.), F.R.Ae.S., A.F.I.A.S., G.I.Mech.E., M.Inst.T.

Wednesday, 14th November 1951—Civil and Aeronautical Structural Test Methods, Professor S. C. Redshaw, M.Sc., Ph.D., F.R.Ae.S., M.I.C.E.

(*Joint meeting with the Institution of Civil Engineers. At the Bristol University Reception Room, at 6.30 p.m.*).

Monday, 3rd December 1951—Some Problems in the Development of Future Fighter Aircraft, P. W. Wreford-Bush, A.F.R.Ae.S.

Tuesday, 18th December 1951—Aeronautical Brains Trust. Question Master: N. E. Rowe, C.B.E., D.I.C., B.Sc., A.C.G.I., F.R.Ae.S.

In the Conference Room, Filton House, Bristol Aeroplane Co., at 6 p.m., unless otherwise stated.

BROUGH BRANCH

Wednesday, 31st October 1951—The First Moon Rocket, E. Burgess.

Wednesday, 21st November 1951—The Probable Role and Influence of Aircraft in Future Warfare, Air Marshal Sir Robert H. M. Saundby, K.B.E., C.B., M.C., D.F.C., A.F.C., R.A.F.(Retired).

Wednesday, 12th December 1951—Thirty Years of Naval Aircraft Development, G. E. Petty, F.R.Ae.S., M.I.Mech.E.

In the Lecture Hall, Electricity Showrooms, Ferensway, Hull, at 7.30 p.m. Admission is by ticket only.

CHESTER BRANCH

Wednesday, 7th November 1951—General Flying, Squadron Leader J. D. Derry, D.F.C.

Tuesday, 4th December 1951—Some Metallurgical Aspects of Engineering Design, L. Marshall, A.F.R.Ae.S., A.I.Mech.E., A.I.M.

At the Grosvenor Hotel, Chester, at 7.30 p.m.

COVENTRY BRANCH

Wednesday, 21st November 1951—The Problems of Integrally Stiffened Wing Structures, A. F. Newall, A.F.R.Ae.S.

Wednesday, 19th December 1951—Film Evening.

In the Wine Lodge (Corner of Corporation Street and The Burges) at 7.30 p.m.

DERBY BRANCH

Monday, 5th November 1951—The Princess, H. Knowler, F.R.Ae.S., A.M.I.C.E.

Monday, 3rd December 1951—The Aviation Engine, Air Commodore F. R. Banks, C.B., O.B.E., F.R.Ae.S.

In the Rolls-Royce Welfare Hall, Nightingale Road, at 6.15 p.m.

GLOUCESTER AND CHELTENHAM

Wednesday, 24th October 1951 (*Gloucester*)—Some Production Problems in Building a Brabazon Aircraft, F. Chard, M.I.Prod.E.

Thursday, 22nd November 1951 (*Cheltenham*)—Problems of Transonic Flight (Main Society Lecture), A. N. Clifton, B.Sc., F.R.Ae.S.

Wednesday, 12th December 1951 (*Gloucester*)—The Effect of Jet Engines on Aircraft Design, H. W. V. Steventon, M.I.Mech.E., A.F.R.Ae.S.

Gloucester Meetings are held in the Wheatstone Hall, City Library, Brunswick Road, at 7.30 p.m.

Cheltenham Meetings are held in the Assembly Hall, St. Mary's College, at 7.30 p.m.

MANCHESTER BRANCH

Thursday, 15th November 1951—A Discussion: Electrics versus Hydraulics, E. R. Legg and H. G. Conway, F.R.Ae.S.

Thursday, 13th December 1951—The Dart Engine, A. D. Jackson, A.F.R.Ae.S., In the Reynolds Hall, College of Technology, Manchester, at 7.30 p.m.

PORTSMOUTH BRANCH

Wednesday, 24th October 1951—Films: Wonders of the Deep, Charting the Seas, The Bristol Brabazon, Once upon a Time, and Down to Earth.

Thursday, 8th November 1951—Testing Flying Boats, G. Tyson, A.F.R.Ae.S.,

Thursday, 22nd November 1951—Films: Buried Treasure, It comes from Coal, Radar goes to Sea, and Airscrew.

Thursday, 6th December 1951—Branch Dinner and Brains Trust—*at Royal Beach Hotel, Southsea, at 7.30 p.m.*

Question Master: The Lord Mayor of Portsmouth, Alderman Albert Johnson, J.P.

Brains Trust: A. Hessell-Tiltman, F.R.Ae.S., Professor E. J. Richards, F.R.Ae.S., and Thurston James.

Thursday, 20th December 1951—Films: Flight Six, West Wind, The Gates of Power, New Town, and Contribution to Victory.

At Airspeed Ltd., The Airport, Portsmouth, at 6 p.m.

SOUTHAMPTON BRANCH

Wednesday, 31st October 1951—Powered Aircraft Controls, D. J. Lyons, B.Sc., A.F.R.Ae.S.

Wednesday, 28th November 1951—Developments in Aircraft Production and Engineering, Professor J. V. Connolly, B.E., F.R.Ae.S.

In the Physics Lecture Theatre, University College, Southampton, at 7 p.m.

WEYBRIDGE BRANCH

Wednesday, 31st October 1951—Operation "Viking," R. C. Morgan, A.F.R.Ae.S.

Wednesday, 7th November 1951—Bombers from the Operators' Point of View, Air Commodore H. Satterly, C.B., C.B.E., D.F.C.

Wednesday, 28th November 1951—Principles of Space Flight, A. C. Clarke, B.Sc., F.R.Ae.S.

Wednesday, 12th December 1951—Brains Trust: Air Vice-Marshal G. W. Tuttle, C.B., O.B.E., D.F.C., A. A. Hall, M.A., F.R.Ae.S., Charles Gardner, O.B.E., A.R.Ae.S., G. R. Edwards, M.B.E., B.Sc., F.R.Ae.S., A.M.I.Struct.E.

Friday, 28th December 1951—ANNUAL DANCE—*St. George's Hill Tennis Club.*

At Vickers-Armstrongs Ltd., Weybridge, at 6 p.m.

ELECTIONS

The following is a list of new members and transfers of membership of the Society:—

Associate Fellows

Cliford Grainger Andrews
Frank Wallace Austin (from Graduate)
Frederick Alfred Cousins (from Graduate)
Harry Derrick (from Graduate)
Leslie William Dixon (from Associate)
John Lancaster Eaton
James Leo O'Reilly
Clarence Herbert Perry (from Graduate)
Robert Richard Shaw

Associates

John Leonard Alton
Leonard Charles Down
Kamel Khalil Effat
Robert William Fredericksen
John Edwin Loxton
John Smith MacDougall (from Student)
Edward Albert Thomas Mack
Norman Frederick Ruse

Graduates

Arthur Sidwell Bennett (from Student)
Joseph Anthony Dietz
Ronald John Yates

Student

John Walter Pooley

CHANGES OF ADDRESS

To assist in keeping the records of members correct and up to date the Secretary will be glad if all members will notify him as soon as possible of changes of address. When notifying changes please give the following particulars:—

Name (in block letters).
Grade of membership.
New address (in block letters).
Old address.

Changes of address must be received *before the 15th of the month* in order to be effective for the JOURNAL for the following month.

ACKNOWLEDGMENTS

The Council acknowledge with grateful thanks the return of back numbers of the JOURNAL from Miss M. M. Hopkins, Major R. H. Mayo, *Fellow*, and Air Commodore Sir Frank Whittle, *Fellow*.

ADDITIONS TO THE LIBRARY

The following have been added to the Library (titles of pamphlets are printed in italics. Books marked * or ** may not be taken out on loan):—

Bergin, K. G.	Collected Papers on Aviation Medicine
Clarke, A. C.	Exploration of Space. Temple Press. 1951.
*Commonwealth Universities Year Book 1951.	G. Bell and Sons. 1951.
Connolly, J. V.	Production Engineering, Administration and Management. " Aircraft Engineering." 1951.
Curry, Beth, *et al*	Bibliography. Supersonics or Ultrasonics. 1926 to 1949, with Supplement to 1950. Oklahoma Agricultural and Mechanical College. 1951.
De Bruyne, N. A. and R. Houwink (editors)	Adhesion and Adhesives. Elsevier Publishing Co. 1951.
Hurren, B. J.	Fellowship of the Air. Iliffe and Sons. 1951.
Hymans, J. C. S.	Guns, Shells and Rockets. A Simple Guide to Ballistics. Gale and Polden. 1950.
Lichty, L. C.	Internal Combustion Engines—6th edition. McGraw-Hill. 1951.
Ministry of Civil Aviation	*Licensing of Aerodromes for Aircraft not exceeding 11,000 lb.* H.M.S.O. 1951.
National Physical Laboratory	Gauging and Measuring Screw Threads. (Notes on Applied Science No. I.) H.M.S.O. 1951.
Pope, A.	Aerodynamics of Supersonic Flight. Pitman (N.Y.) 1951.
Ward, V. K.	*Development of Balloons and Airships. Thesis.* 1951.

A.R.C. Reports and Memoranda

2437—*Turbulence changes in contracting and distorted passages. D. C. MacPhail.*
2474—*Revised high-speed lift and drag data for Clark Y sections for propeller performance calculations. A. R. C. MacDougall.*
2488—*Preliminary note on the use of light alloys having high values of the modulus but low proof stresses. H. L. Cox.*
2492—*Aircraft flutter. J. Williams.*
2497—*Effect of current variation on the out-of-balance of strain gauge bridges. J. B. B. Owen.*
2516—*Comparison of pusher and tractor propellers mounted on a wing. J. S. Thompson, R. Smelt, B. Davidson and F. Smith.*
2531—*A method of testing smooth wings for initial shape and resistance to distortion under load. J. C. King and D. H. Trollope.*
2539—*Influence of the testing machine on the flexural failure of panels. W. S. Hemp.*
2601—*Theoretical velocity distribution in a high-speed tunnel contraction. M. Jones and P. Bright.*
2605—*An approximation simplifying wing flutter calculations. G. A. Naylor.*

2608—*Estimation of wing flutter speeds from the curves of R. and M. 1869. Mary E. K. Graham.*
2614—*A résumé of aerodynamic data on air brakes. H. Davies and F. N. Kirk.*
2649—*24-ft. tunnel tests on a high-lift model. Downwash and velocity measurements at the tailplane. C. H. Naylor.*
2675—*Creep tests on some cast magnesium alloys. Parts I, II and III. A. E. Johnson, H. J. Tapsell and H. D. Conway.*
2682—*The correlation of aeroplane loading and accident statistics. A. G. Pugsley.*

Aeronautical Research Consultative Committee, Australia. Reports

ACA 49—*Corrosion of metals. Metals under stress: 1. Aluminium. P. F. Thompson.*
ACA 50—*An investigation into engine wear caused by dust. R. V. Pavia.*
ACA 52—*Observation of the lubricating oil film between piston ring and cylinder of a running engine. The effects of ring geometry. R. L. Brooks and M. L. Atkin.*

Aeronautical Research Laboratories, Australia

Aerodynamics Note 103—*Resistance coefficients of wire gauzes. P. E. Turner.*
Report A.17—*Flight tests of the suction wing glider. T. S. Keeble.*
Report SM.168—*The contribution of intergranular movements to the plastic flow of aluminium. W. A. Rachinger.*

Ministère de l'Air, France. Publications scientifiques et techniques

No. N.T.42—*Fonctions biharmoniques doublement complexes et applications aux problèmes d'élastostatique. R. Legendre.*
No. B.S.T.115—*Méthode des différences finies appliquée aux problèmes bidimensionnels de calcul des contraintes d'une plaque. F. Salles et C. Thorn.*
No. 250—*Actes du colloque international de mécanique. Poitiers 1950. Tome II. Etude sur la mécanique des fluides.*

Mitteilungen aus dem Institut fur Aerodynamik, Zürich

18—*Experiments on aerodynamic cooling. Lloyd F. Ryan. Untersuchungen an einem Gegenlaufpropeller im Windkanal. M. Degen.*

National Advisory Committee for Aeronautics, U.S.A.
Reports

971—*Theoretical stability derivatives of thin sweptback wings tapered to a point with sweptback or sweptforward trailing edges for a limited range of supersonic speeds. F. S. Malvestuto, Jr. and K. Margolis.*
972—*The effect of torsional flexibility on the rolling characteristics at supersonic speeds of tapered unswept wings. W. A. Tucker and R. L. Nelson.*
976—*Linear theory of boundary effects in open wind tunnels with finite jet lengths. S. Katzoff, C. S. Gardner, L. Diesendruck and B. J. Eisenstadt.*
996—*Free-space oscillating pressures near the tips of rotating propellers. H. H. Hubbard and A. A. Regier.*
999—*Investigation of the NACA 4-(3) (08)-03 and NACA 4-(3) (08)-045 two-blade propellers at forward Mach numbers to 0.725 to determine the effects of compressibility and solidity on performance. J. Stack, E. C. Draley, J. B. Delane and L. Feldman.*

***Technical Memoranda**

1273—*Resonance sound absorber with yielding wall. S. N. Rzhevkin.*
1282—*Theory of flame propagation. Y. B. Zeldovich.*

1291—*On stability and turbulence of fluid flows. W. Heisenberg.*
1295—*Gas flow with straight transition line. L. V. Ovsiannikov.*
1296—*On the theory of combustion of initially unmixed gases. Y. B. Zeldovich.*
1298—*On the problem of gas flow over an infinite cascade using Chaplygin's approximation. G. A. Bugaenko.*

***Technical Note**

2164—*Axial-momentum theory for propellers in compressible flow. A. W. Vogeley.*

Civil Aeronautics Administration, Indianapolis, Indiana

Technical Development Report No. 120—*Performance tests of the Narco VHF omnireceiver. D. S. Crippen and W. L. Seibert.*

THE ROYAL AERONAUTICAL SOCIETY

4 Hamilton Place, Piccadilly, London, W.1. Tel.: Grosvenor 3515-9

THE LEWES PRESS (Wightman & Co. Ltd.), Friars Walk, Lewes, Sussex.

SECRETARY'S NEWS LETTER

NOVEMBER 1951

IT WAS UNFORTUNATE that Sir Leonard Isitt was unable to make the journey from New Zealand to give the Seventh British Commonwealth and Empire Lecture on 4th October, but we were fortunate in that Mr. T. A. Barrow was able to read the paper for him. Following the lecture the Council gave a dinner at 4 Hamilton Place to Mr. Barrow and other guests from various branches of civil aviation in this country and the Empire.

On 16th October I visited Hawkers, at the invitation of Mr. Sidney Camm, the Chief Designer and a Vice-President of the Society. I spent an interesting time in the works and also had an opportunity of seeing the impressive array of photographs of aircraft designed by the Hawker Siddeley Group of companies. These are arranged in the corridor outside Mr. Camm's room and range from the Sopwith Tabloid of 1914 to the Hawker P-1067 of 1951. In spite of such a galaxy of aeroplanes, to me H A W K E R always spells H U R R I C A N E.

The Halton Branch of the Society held its Annual General Meeting, under the chairmanship of Air Commodore Elton, the Station Commander, on Saturday 6th October; and I attended with Mr. D. C. Smith. This is a very active branch, although one of the youngest. It is fortunate in having had a large hall on the station placed at its disposal for meetings and at the A.G.M. it was decided to name it the "Lawrence Deane Hall," in memory of the first chairman and founder of the branch, Wing Commander L. A. Deane, whose tragic death this summer I mentioned last month. In addition, there is a proposal to found a Laurence Deane Memorial Prize, details of which have yet to be decided. The new chairman is Group Captain Rapley and Mr. J. N. Angless is the energetic honorary secretary.

Following the Annual General Meeting the branch held a debate on "Landplanes *versus* Flying Boats," with Mr. A. E. Russell, of Bristols, supporting landplanes and Mr. D. Keith-Lucas, of Shorts, arguing for flying boats. Each was supported by a cadet and the referee was Air Vice-Marshal R. O. Jones. Although flying boats won this round, the discussion proved that as always there are strong supporters for both these types. It was an amusing and interesting debate.

The Halton Branch and the bay tree have much in common.

Another enjoyable occasion was the Royal Aero Club Jubilee Ball at Londonderry House, which my wife and I attended. This function was graced by the presence of Her Royal Highness Princess Margaret, and the Secretary-General of the Royal Aero Club and his staff are to be warmly congratulated on a highly successful affair.

Mr. Peter Masefield was the Question Master at a Brains Trust organised by the Luton Branch on 29th October, with Air Marshal Sir Conrad Collier, President of the Branch, in the chair. The team consisted of Mr. F. M. Owner, of de Havillands, Sir Victor Goddard, Principal of the College of Aeronautics, Mr. D. Keith-Lucas, of Shorts, and Mr. J. Quill, of Vickers Supermarine. The series of questions, which

were mostly serious and technical, were dealt with in an interesting manner and with some humour—both subtle and obvious.

Before the meeting the branch held a small dinner at which were present the members of the Brains Trust, a few other guests, the President of the Branch, Air Marshal Sir Conrad Collier, the Chairman, Mr. F. S. Lester, the Honorary Secretary, Mr. P. A. Drillien and past and present members of the Committee.

The Branches Conference was held on Saturday 20th October under the chairmanship of Mr. N. E. Rowe. Sixteen branches were represented, including Belfast and Glasgow; everyone appeared very keen and a number of points were debated with vigour. At one time three Scots and a Welshman were arguing, but the Chairman, an Englishman, settled the issue in one sentence—much to the amusement of the Conference.

Enclosed with the November JOURNAL, or with these Notices, will be found a leaflet entitled, "Notes for the Guidance of Those Wishing to Join the Society." These have been prepared by the Grading Committee of the Council and I think that they will answer many of the queries of those who wish to become Associate Fellows and members in other grades.

Several members of Council are having a particularly busy time just now. Mr. G. R. Edwards has just returned from a six weeks visit to the United States and Mr. Walter Tye left shortly after giving his lecture on 18th October, on a visit to Australia. Mr. S. Scott Hall is leaving almost immediately for the same destination. "Bon Voyage" and "Safe Home" are our two wishes.

I am very pleased to be able to say that the progress of the President continues to give satisfaction. Let it continue !

A. M. Ballantyne

Secretary

NOTICES

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The Third Anglo-American Aeronautical Conference.
Seventh British Commonwealth and Empire Lecture—Air Transport in New Zealand and the South Pacific, Sir Leonard Isitt, K.B.E.
Recent Development in Methods of Strength Testing Pressurised Fuselages, A. W. Hotson, B.Sc., A.M.I.Mech.E.
The Accidental Carriage of Insects on Board Aircraft, Marshall Laird, M.Sc., Ph.D.
Reviews. Correspondence.

The Council are particularly anxious to encourage members of the Society to support their own Journal by contributions to it of articles and papers on any aspect of Aeronautics. For that purpose they have set aside £250 a year in the form of premium awards to the authors (members or non-members) of such papers as some reimbursement for their work. These premium awards are not fixed but vary from five to twenty guineas normally. It is hoped that those members who have written papers on their special subjects will consider their own Journal in the first place.

THE AERONAUTICAL QUARTERLY—Part II, Volume III

Part II, Volume III of the Aeronautical Quarterly is still available. The Contents of Part II are:—

The Construction and Testing of a Xylonite Model of a Delta Aircraft	S. C. Redshaw and P. J. Palmer
A Note on the Stressing of Oleo-Pneumatic Shock Absorbers	D. M. A. Leggett
The Anti-Symmetric Vibrations of Aircraft	R. W. Traill-Nash
The Flow of an Incompressible Fluid through an Axial Turbo-Machine with any Number of Rows	J. W. Railly

Copies of Part I, Volume III, of "The Aeronautical Quarterly" are still available from the offices of the Society at 7s. 9d. a copy to members of the Society, post-paid, or 10s. 3d. to non-members, post-paid.

The contents of Part I, Volume III, are:—

The Symmetric Vibrations of Aircraft	R. W. Traill-Nash
Airscrews at Supersonic Forward Speeds	J. C. Burns
Polhausen's Method for Three - Dimensional Laminar Boundary Layers	J. C. Cooke
Supersonic Flow Past Bodies of Revolution with Thin Wings	P. M. Stocker

Copies of Volume II, Parts I to IV and a few copies of Volume I, Parts I to IV are still available, but members are reminded that a limited edition only of "The Aeronautical Quarterly" is printed.

COMMITTEE MEETINGS HELD IN OCTOBER

A meeting of the Council was held on 25th October. Among the items discussed were the Wilbur Wright Memorial Lecture for 1952; the Report of the Scholarship Committee; the Report of the Grading Committee; the Branches Conference; and attendance at lectures.

During October seven meetings were held by Committees of the Society. Outside bodies engaged in aircraft engineering and research held 20 meetings in the offices of the Society.

MEMBERS' NEW APPOINTMENTS

SIR ALEC CORYTON, K.C.B., K.B.E., M.V.O., D.F.C. (*Associate Fellow*) has been appointed Managing Director of the Engine Division of the Bristol Aeroplane Company. Sir Alec will take up his appointment on his retirement from his present post of Chief Executive, Guided Weapons, at the Ministry of Supply.

PROFESSOR W. S. HEMP, M.A. (*Associate Fellow*) has been appointed Head of the Department of Aircraft Design at the College of Aeronautics, Cranfield, but will also retain his title of Professor of Aircraft Structures and Aero-Elasticity.

P. J. PALMER (*Associate Fellow*), formerly of Boulton Paul Aircraft Ltd., has been appointed Lecturer in Civil Engineering at the University of Birmingham.

T. SIMPSON (*Associate Fellow*), formerly Chief Designer, has been appointed Assistant Managing Director of H. M. Hobson Ltd. He has been with the company since 1926.

P. H. STOKES (*Associate Fellow*) has been appointed Technical Director of H. M. Hobson Ltd. He was formerly Chief Development Engineer and joined the company in 1939.

ASSOCIATE FELLOWSHIP EXAMINATION

The next Associate Fellowship Examinations will be held in the offices of the Society on Tuesday, Wednesday and Thursday, 18th, 19th and 20th December. Particulars of time-tables and general arrangements have been sent direct to all candidates.

CAPTAIN J. LAURENCE PRITCHARD

In response to a number of enquiries from members, the following is the home address of Captain Pritchard:—

The Woodpeckers,
Preston Park,
Brighton, Sussex.

LEVERHULME RESEARCH FELLOWSHIPS 1952

Applications are invited for Fellowships and Grants in aid for research. The Fellowships are limited to British-born subjects and are intended for senior workers who are prevented by routine duties or pressure of other work from carrying out research. Application forms may be obtained from the Secretary, Leverhulme Research Fellowships, 3/5 Salisbury Square, London, E.C.4. Applications must be received by 31st December; awards are announced in May and will date from 1st September 1952.

UNIVERSITY COLLEGE SOUTHAMPTON—SCHOLARSHIPS

A number of scholarships at University College, Southampton, will be awarded to candidates with Industrial experience for a course of study from Matriculation, or preferably Intermediate standard, to the B.Sc. Engineering Degree. The Scholarships will be tenable for three or four years.

The value of each Spitfire Mitchell Scholarship is £60 per annum and of each Open Industrial Scholarship, £40 per annum. Candidates must have attained the age of 17 years by 1st March in the year of the examination but there is no upper age limit. Application forms, which must be returned by 20th December 1951, may be obtained from the Academic Registrar, University College, Southampton.

MAIN LECTURES—AUTUMN SESSION 1951

(At 6 p.m. in the Lecture Hall of the Institution of Civil Engineers, Great George Street, London, S.W.1, unless otherwise stated. Tea will be served at 5.30 p.m.)

Thursday, 22nd November 1951—AT CHELTENHAM—Problems of Transonic Flight, A. N. Clifton, F.R.Ae.S. **At St. Mary's College, at 7.30 p.m.**

Thursday, 29th November 1951—Structural Problems in Advanced Aircraft, H. H. Gardner, F.R.Ae.S.

Thursday, 6th December 1951—Air Intakes for Gas Turbines, J. Seddon, A.F.R.Ae.S.

Thursday, 20th December 1951—Control Surface Flutter, E. G. Broadbent, A.F.R.Ae.S., and W. T. Kirkby, A.F.R.Ae.S.

SECTION LECTURE

(At 7 p.m. in the Library of the Royal Aeronautical Society, 4 Hamilton Place, London, W.1)

Tuesday, 27th November 1951—Is It Possible to Simplify Aircraft and Still Maintain their Efficiency? W. S. Farren, F.R.Ae.S.

GRADUATES' AND STUDENTS' SECTION

LECTURE

(At 7.30 p.m. in the Library of the Royal Aeronautical Society, 4 Hamilton Place, London, W.1)

Tuesday, 11th December 1951—Naval Aircraft, D. L. Hollis Williams, F.R.Ae.S.

BRANCH NOTICES

BRISTOL BRANCH

Monday, 3rd December 1951—Some Problems in the Development of Future Fighter Aircraft, P. W. Wreford-Bush, A.F.R.Ae.S.

Tuesday, 18th December 1951—Aeronautical Brains Trust. Question Master: N. E. Rowe, C.B.E., D.I.C., B.Sc., A.C.G.I., F.R.Ae.S.

In the Conference Room, Filton House, Bristol Aeroplane Co., at 6 p.m.

BROUGH BRANCH

Wednesday, 21st November 1951—The Probable Role and Influence of Aircraft in Future Warfare, Air Marshal Sir Robert H. M. Saundby, K.B.E., C.B., M.C., D.F.C., A.F.C., R.A.F.(Retired).

Wednesday, 12th December 1951—Thirty Years of Naval Aircraft Development, G. E. Petty, F.R.Ae.S., M.I.Mech.E.

In the Lecture Hall, Electricity Showrooms, Ferensway, Hull, at 7.30 p.m. Admission is by ticket only.

CHESTER BRANCH

Tuesday, 4th December 1951—Some Metallurgical Aspects of Engineering Design, L. Marshall, A.F.R.Ae.S., A.I.Mech.E., A.I.M.

At the Grosvenor Hotel, Chester, at 7.30 p.m.

COVENTRY BRANCH

Wednesday, 21st November 1951—The Problems of Integrally Stiffened Wing Structures, A. F. Newall, A.F.R.Ae.S.

Wednesday, 19th December 1951—FILM Evening.

In the Wine Lodge (Corner of Corporation Street and The Burges) at 7.30 p.m.

DERBY BRANCH

Monday, 3rd December 1951—The Aviation Engine, Air Commodore F. R. Banks, C.B., O.B.E., F.R.Ae.S.—A joint meeting with the Derby Branch of the Institution of Mechanical Engineers.

In the Rolls-Royce Welfare Hall, Nightingale Road, at 6.15 p.m.

GLOUCESTER AND CHELTENHAM

Thursday, 22nd November 1951 (*Cheltenham*)—Problems of Transonic Flight (Main Society Lecture), A. N. Clifton, B.Sc., F.R.Ae.S.

Wednesday, 12th December 1951 (*Gloucester*)—The Effect of Jet Engines on Aircraft Design, H. W. V. Steventon, M.I.Mech.E., A.F.R.Ae.S.

Gloucester Meetings are held in the Wheatstone Hall, City Library, Brunswick Road, at 7.30 p.m.

Cheltenham Meetings are held in the Assembly Hall, St. Mary's College, at 7.30 p.m.

MANCHESTER BRANCH

Thursday, 13th December 1951—The Dart Engine, A. D. Jackson, A.F.R.Ae.S., In the Reynolds Hall, College of Technology, Manchester, at 7.30 p.m.

PORTSMOUTH BRANCH

Thursday, 22nd November 1951—FILMS: Buried Treasure, It comes from Coal, Radar goes to Sea, and Airscrew.

Thursday, 6th December 1951—Branch Dinner and Brains Trust—*at Royal Beach Hotel, Southsea, at* 7.30 *p.m.*
Question Master: The Lord Mayor of Portsmouth, Alderman Albert Johnson, J.P.
Brains Trust: A. Hessell-Tiltman, F.R.Ae.S., Professor E. J. Richards, F.R.Ae.S., and Thurston James.

Thursday, 20th December 1951—FILMS: Flight Six, West Wind, The Gates of Power, New Town, and Contribution to Victory.
At Airspeed Ltd., The Airport, Portsmouth, at 6 p.m.

SOUTHAMPTON BRANCH

Wednesday, 28th November 1951—Developments in Aircraft Production and Engineering, Professor J. V. Connolly, B.E., F.R.Ae.S.
In the Physics Lecture Theatre, University College, Southampton, at 7 p.m.

WEYBRIDGE BRANCH

Wednesday, 28th November 1951—Principles of Space Flight, A. C. Clarke, B.Sc., F.R.Ae.S.

Wednesday, 12th December 1951—Brains Trust: Air Vice-Marshal G. W. Tuttle, C.B., O.B.E., D.F.C., A. A. Hall, M.A., F.R.Ae.S., Charles Gardner, O.B.E., A.R.Ae.S., G. R. Edwards, M.B.E., B.Sc., F.R.Ae.S., A.M.I.Struct.E.

Friday, 28th December 1951—ANNUAL DANCE—*St. George's Hill Tennis Club.*
At Vickers-Armstrongs Ltd., Weybridge, at 6 p.m.

ELECTIONS

The following is a list of new members and transfers of membership of the Society:—

Associate Fellows
Harry Derrick; Miroslav Nenadovich.

Associate
Sydney Highfield Edwards.

Graduates
Kenneth John Lelliott; David Edgar Thomas Nichols.

ACKNOWLEDGMENTS

The President and Council wish to acknowledge a most valuable gift from Wing Commander R. H. Stocken, *Associate Fellow*, of a complete file of "Inter Avia." This file will form a valuable addition to the Society's archives as it represents the story of international aviation over some twenty years.

The Council also acknowledge with grateful thanks the return of back numbers of the Journal from: W. Tye, Esq., *Fellow*; Group Captain E. G. M. Neville, *Associate Fellow*; and the Bristol Aeroplane Co.

CHANGES OF ADDRESS

To assist in keeping the records of members correct and up to date the Secretary will be glad if all members will notify him as soon as possible of changes of address.
When notifying changes please give the following particulars:—

Name (in block letters).
Grade of membership.
New address (in block letters).
Old address.

Changes of address must be received *before the* 15*th of the month* in order to be effective for the JOURNAL for the following month.

ANNUAL SUBSCRIPTIONS

Members are reminded that their annual subscriptions become due on 1st January 1952. The rates are:—

	Home	Abroad
	£ s. d.	£ s. d.
Fellows	5 5 0	4 4 0
Associate Fellows	4 4 0	3 3 0
*Associates	3 3 0	3 3 0
Graduates (aged under 26) ...	2 2 0	2 2 0
Graduates (aged 26 and over) ...	2 12 6	2 12 6
Students (aged under 21)	1 1 0	1 1 0
Students (aged 21 and over) ...	1 11 6	1 11 6
Companions	3 3 0	3 3 0
Founder Members	2 2 0	2 2 0

* Any Associate elected before 1st October 1947 may, if he wishes, elect not to receive the JOURNAL, and in this case his subscription will be reduced by £1 1s. 0d. to £2 2s. 0d.

It will avoid delay and confusion if members, when sending remittances for subscriptions, will state their names clearly and give their addresses and grades of membership.

Remittances should be made payable to the Royal Aeronautical Society.

ADDITIONS TO THE LIBRARY

The following have been added to the Library (titles of pamphlets are printed in italics; books marked * or ** may not be taken out on loan):—

Brickhill, P.	The Dam Busters. Evans Bros. 1951.
Brown, W. D.	Parachutes. Pitman. 1951.
Cohen, H. and G. F. C. Rogers	Gas Turbine Theory. Longmans Green. 1951.
Dommasch, D. O., S. S. Sherby and T. F. Connolly	Airplane Aerodynamics. Pitman (N.Y.). 1951.
Fisher, C. H.	Carburation, Vol. I. Chapman & Hall. 1951.
Ghaffari, A. G.	Hodograph Method in Gas Dynamics. Tehran University. 1950.
Goldstein, H.	Classical Mechanics. Addison-Wesley. 1951.
*Gowers, Sir Ernest	A.B.C. of Plain Words. H.M. Stationery Office. 1951.
Gross, R. E.	*What Price Air Power—Are We Getting Our Money's Worth? Lockheed Aircraft Corporation. 1951.*
Jackson, C. H.	*Industrial Design in B.O.A.C. Council of Industrial Design. 1951.*
Kloucek, C. V.	*Structural Analysis by Distribution of Deformation. Reprint from the Quarterly of Applied Mechanics. 1951.*
Lockspeiser, Sir Ben	*Aviation: Scientific and Technical Developments (Historical). British Association. 1951.*
Lewis, B. and G. von Elbe	Combustion, Flames and Explosions of Gases. Academic Press. 1951.
Macmillan, R. H.	The Theory of Control in Mechanical Engineering. Cambridge University Press. 1951.
Mond Nickel Co.	Nickel Cast Iron. Mond Nickel Co. 1951.

Murray, W. M. (editor)	Proceedings of the Society for Experimental Stress Analysis, Vol. VIII, Parts 1 and 2. 1950/1.
Murray, G. L .	American (3rd angle) and British (1st angle) Projection. Toledo Woodhead Springs Ltd. 1951.
Oldenburger, R.	Mathematical Engineering Analysis. Macmillan (N.Y.). 1950.
Plesman, Dr. A.	*Industrial Design in Dutch Aviation. Council of Industrial Design. 1951.*
Proell, W. and N. J. Bowman	Handbook of Space Flight. Perastadion Press. 1950.
Samaras, D. G.	Fluid Dynamics of Energy Release. Office of Air Research. 1951.
Samaras, D. G.	Heat Propagation, Past and Future. Office of Air Research. 1951.
Scanlan, R. H. and R. Rosenbaum	Aircraft Vibration and Flutter. Macmillan (N.Y.). 1951.
U.S. Air Force—Navy—Commerce	Sandwich Construction for Aircraft, Part I. U.S.G.P.O. 1951.
Vaeth, J. G.	200 Miles Up. Ronald Press. 1951.
Wade, T. L.	The Algebra of Vectors and Matrices. Addison-Wesley. 1951.

A.R.C. Current Papers

47—*Dynamic stability of the helicopter; the equations of motion. A. H. Yates.*
48—*Data on flight loads obtained with Miller recording equipment with particular reference to test flights in Lancaster PD.119. Anne Burns.*
49—*Notes on definitions of and nomenclature for "Air Speeds." A.A.E.E. staff.*
50—*List of current papers published by the A.R.C. Nos. 1-50.*
51—*Calculation of the damping for rolling oscillations of a swept wing. Doris E. Lehrian.*
52—*The measurement of the derivative z_w for an oscillating aerofoil. A. L. Buchan, K. D. Harris and P. M. Somervail.*
53—*Observations of the interaction between the shock waves and boundary layers at the trailing edges of aerofoils in supersonic flow. D. W. Holder and R. J. North.*

A.R.C. Reports and Memoranda

2364—*Low-speed model tests on two "V" wings. J. Trouncer and D. Kettle.*
2420—*The boundary-layer cooling of a flat plate: a contribution to a discussion on the cooling of gas turbine blades. R. E. Meyer.*
2423—*The effect of internal pressure on the initial buckling of thin-walled circular cylinders under torsion. H. G. Hopkins and E. H. Brown.*
2445—*Some observations on diffusion flames at low pressures. F. H. Holderness.*
2466—*Sandwich construction—a practical approach for the use of designers. D. Williams.*
2467—*Sandwich construction and core materials, Part IV. Notes on some methods of testing core materials. F. T. Barwell.*
2472—*Strain gauge investigation of propeller flutter. L. H. G. Sterne, H. G. Ewing and J. Kettlewell.*
2490—*The relative strength and stiffness properties required for strut materials. A. G. Pugsley.*
2521—*An investigation in flight of the induced velocity distribution under a helicopter rotor when hovering. P. Brotherhood.*

2530—*An experimental investigation into the suitability of a corrugated construction wing for a laminar-flow aerofoil. J. C. King.*
2532—*Photo-elastic examination of a cylindrical strut intended for recording compressive loads. W. A. P. Fisher.*
2538—*Note on the effect of boundary-layer suction on separation. E. J. Watson.*
2595—*Tests of model propellers in the high speed tunnel: thrust and torque measurements on a 2-blade, 6 per cent. thick, Clark Y section propeller. G. S. Hislop and J. Caldwell.*
2598—*The behaviour in compression of aluminium alloy panels having a flat skin with corrugated reinforcement. E. A. Brook.*
2618—*Stress diffusion adjacent to gaps in the inter-spar skin of a stressed-skin wing. M. Fine and H. G. Hopkins.*
2643—*Notes on the design of converging channels. S. Goldstein.*
2674—*A note on a rotating bending-fatigue machine for tests at 200°C C. E. Phillips and R. C. A. Thurston.*
2676—*Notes on the tail-first aeroplane. S. B. Gates.*
2677—*Proposal for an elevator manœvrability criterion. S. B. Gates.*

Aeronautical Research Laboratories, Australia

Aerodynamics Note 101—*The effect of excrescences on transition; some observations in the boundary layer on Williams Glas II profile. T. S. Keeble and P. B. Atkins.*
Structures and Materials Note 187—*Approximating functions for the buckling modes of flat oblique plates. J. J. Thompson.*

National Research Council of Canada, Reports

AR-8—*Calculation of manœuvring tail loads by the inverse method. B. Etkin and F. A. Woodward.*
MA-240—*The streamline pattern in the vicinity of a certain Joukowski aerofoil, with and without yaw. M. M. Callan.*
MT-20—*An experimental investigation of protection achieved by sweat cooling on porous surfaces adjacent to non-porous surfaces. E. Duncombe.*
Note 6—*Method for measuring the size of water droplets in clouds, fogs and sprays—N. Golitzine.*

O.N.E.R.A., France

Publication No. 48—*Statique de l'aile en flèche. 2ème partie. Influence de la variation longitudinale des efforts intérieurs sur la répartition des contraintes. W. Flügge.*

Mitteilungen aus dem Max-Planck-Institut fur Stromungsforschung, Göttingen

Nr. 4—*Experimentelle Untersunchung der kompressiblen Strömung an und in der Nähe einer gewölbten Wand. W. Frössel.*

National Advisory Committee for Aeronautics, U.S.A.
***Technical Memorandum**

1058—*The theory of a free jet of a compressible gas. G. N. Abramovich.*

***Technical Notes**

1950—*Damping-in-roll calculations for slender swept-back wings and slender wing-body combinations. H. Lomax and M. A. Heaslet.*
1968—*Flight tests of the hydrodynamic characteristics of a Japanese "Emily" flying boat. J. A. Ferguson, R. E. Seibels, Jr., and R. J. Corber.*
1995—*Influence of wing flexibility on force-time relation in shock strut following vertical landing impact. A. E. McPherson, J. Evans, Jr. and S. Levy.*

2222—*A method for the determination of the spanwise load distribution of a flexible swept wing at subsonic speeds. R. B. Skoog and H. H. Brown.*

2311—*Flight investigation of the variation of static-pressure error of a static-pressure tube with distance ahead of a wing and a fuselage. W. Gracey and E. F. Scheithauer.*

2323—*Theoretical investigation of submerged inlets at low speeds. A. H. Sacks and J. R. Spreiter.*

2468—*Vaporization rates and heat-transfer coefficients for pure liquid drops. R. D. Ingebo.*

2377—*Effect of fuel immersion on laminated plastics. W. A. Crouse, Margie Carickhov and Margaret A. Fisher.*

2379—*An investigation of the effects of jet-outlet cut-off angle on thrust direction and body pitching moment. J. R. Blackaby.*

2380—*Effectiveness of ceramic coatings in reducing corrosion of five heat-resistant alloys by lead-bromide vapors. D. G. Moore and Mary A. Mason.*

2381—*Effect of horizontal-tail location on low-speed static longitudinal stability and damping in pitch of a model having 45° sweptback wing and tail surfaces. J. H. Lichtenstein.*

2382—*Effect of horizontal-tail size and tail length on low-speed static longitudinal stability and damping in pitch of a model having 45° sweptback wing and tail surfaces. J. H. Lichtenstein.*

2384—*Preliminary investigation of wear and friction properties under sliding conditions of materials suitable for cages of rolling contact bearings. R. L. Johnson, M. A. Swikert and E. E. Bisson.*

2385—*Fundamental aging effects influencing high-temperature properties of solution-treated Inconel X. D. N. Frey, J. W. Freeman and A. E. White.*

2387—*Three-dimensional unsteady lift problems in high-speed flight—the triangular wing. H. Lomax, M. A. Heaslet and F. B. Fuller.*

2388—*Axisymmetric supersonic flow in rotating impellers. A. W. Goldstein.*

2389—*Fatigue strengths of aircraft materials. Axial-load fatigue tests on notched sheet specimens of 24S-T3 and 75S-T6 aluminum alloys and of SAE 4130 steel with stress-concentration factors of 4.0. H. J. Grover, S. M. Bishop and L. R. Jackson.*

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2391—*Further comparisons of theoretical and experimental lift and pressure distributions on airfoils in cascade at low-subsonic speed. S. Katzoff and Margery E. Hannah.*

2392—*Charts giving critical compressive stress of continuous flat sheet divided into parallelogram-shaped panels. R. A. Anderson.*

2393—*Flow through cascades in tandem. W. E. Spraglin.*

2394—*Effects of design detail on the fatigue strength of 355-T6 sand-cast aluminum alloy. M. Holt and I. D. Eaton.*

2395—*Bench-test investigation of the transient-response characteristics of several simulated airplanes incorporating an autopilot sensitive to yawing accelerations. D. A. Howard.*

2396—*Single-degree-of-freedom-flutter calculations for a wing in subsonic potential flow and comparison with an experiment. H. L. Runyan.*

2397—*Influence of tensile strength and ductility on strengths of rotating disks in presence of material and fabrication defects of several types. A. G. Holmes, J. E. Jenkins and A. J. Repko.*

2398—*Synthesis of cyclopropane hydrocarbons from methylcyclopropyl ketone III —2-cyclopropyl-1-butene, cis and trans 2-cyclopropyl-2-butene, and 2-cyclopropylbutane. V. A. Slabey and P. H. Wise.*

2399—*Applicability of the hypersonic similarity rule to pressure distributions which include the effects of rotation for bodies of revolution at zero angle of attack. V. J. Rossow.*

2400—*Evaluation of the reduced-mass method of representing wing-lift effects in free-fall drop tests of landing gears. B. Milwitzky and D. C. Lindquist.*

2401—*Temperature distribution in internally heated walls of heat exchangers with non-circular flow passages using coolants with very low Prandtl number. E. R. G. Eckert and G. M. Low.*

2402—*Construction and use of charts in design studies of gas turbines. S. Alpert and Rose M. Litrenta.*

2403—*The indicial lift and pitching moment for a sinking or pitching two-dimensional wing flying at subsonic or supersonic speeds. H. Lomax, M. A. Heaslet and Loma Sluder.*

2405—*Investigation of NACA 64, 2-432 and 64, 3-440 airfoil sections with boundary-layer control and an analytical study of their possible applications. E. A. Horton, S. F. Racisz and N. J. Paradiso.*

2406—*Application of X-ray absorption to measurement of small air-density gradients. Ruth N. Weltmann, S. Fairweather and D. Papke.*

2407—*Method of analysis for compressible flow past arbitrary turbomachine blades on general surface of revolution. Chung-Hua Wu and C. A. Brown.*

2408—*Approximate design method for high-solidity blade elements in compressors and turbines. J. D. Stanitz.*

2409—*Summary of methods for calculating dynamic lateral stability and response and for estimating lateral stability derivatives. J. P. Campbell and M. O. McKinney.*

2410—*Analytical investigation of fully developed laminar flow in tubes with heat transfer with fluid properties variable along the radius. R. G. Deissler.*

2411—*Method of determining initial tangents of contours of flow variables behind a curved, axially symmetric shock wave. G. P. Wood and P. B. Gooderum.*

2413—*Flight investigation of the effect of control centring springs on the apparent spiral stability of a personal-owner airplane. J. P. Campbell, P. A. Hunter, D. E. Hewes and J. B. Whitten.*

2414—*An experimental determination of the critical bending moment of a box beam stiffened by posts. P. F. Barrett and P. Seide.*

2415—*Experimental study of an angle-of-attack vane mounted ahead of the nose of an airplane for use as a sensing device for an acceleration alleviator. C. C. Kraft, Jr., and A. Assadourian.*

2416—*Theoretical study of some methods for increasing the smoothness of flight through rough air. W. H. Phillips and C. C. Kraft, Jr.*

2417—*Preliminary study of stability of flow from two ducts discharging into a common duct. A. I. Bellin, D. R. Messina and P. B. Richards.*

2418—*Flow separation ahead of blunt bodies at supersonic speeds. W. E. Moeckel.*

2419—*Correlation of physical properties with molecular structure for dicyclic hydrocarbons II—2-alkylbiphenyl and the two isomeric 2-alkylbicyclohexyl series. I. A. Goodman and P. H. Wise.*

2420—*Investigation of 75-millimeter-bore cylindrical-roller bearings at high speeds III—Lubrication and cooling studies—oil inlet distribution, oil inlet temperature and generalized single-oil-jet cooling-correlation analysis. E. F. Macks and Z. N. Nemeth.*

2421—*A rapid approximation method for determining velocity distribution on impeller blades of centrifugal compressors. J. D. Stanitz and V. D. Prian.*

2422—*Study of chromium-frit-type coatings for high-temperature protection of molybdenum. D. G. Moore, L. H. Bolz, J. W. Pitts and W. N. Harrison.*

2423—*Theoretical aerodynamic characteristics of bodies in a free-molecule-flow field. J. R. Stalder and V. J. Zurick.*

Civil Aeronautics Administration, Indianapolis, Indiana, U.S.A.
Technical Development Reports

No. 64—*Determination of ignition characteristics of hydraulic fluids. Part I Simulated flight and crash conditions. J. J. Gassman.*

No. 142—*Determination of ignition characteristics of hydraulic fluids. Part II Flammability reference scale. J. J. Gassman.*

No. 143—*Development and flight tests of the CAA type VI course line computer. H. Kay.*

No. 146—*Evaluation of flight fire protection means for inaccessible aircraft baggage compartments. L. A. Asadourian.*

THE ROYAL AERONAUTICAL SOCIETY

4 Hamilton Place, Piccadilly, London, W.1. Tel.: Grosvenor 3515-9

THE LEWES PRESS (Wightman & Co. Ltd.), Friars Walk, Lewes, Sussex.

Royal Aeronautical Society

Notes for the guidance of those wishing to join the Society in any of its classes

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This note has been prepared to assist those wishing to join the Society.

It is emphasised that the Council does not necessarily accept a definition given by an applicant of the position he holds, as definitions vary considerably throughout the Industry.

Throughout this note, wherever reference is made to aircraft or aero engines it can be assumed that this includes Guided Weapons, Unmanned Aircraft, Helicopters and their power plants.

There are seven classes of membership of the Royal Aeronautical Society and for each of these, special conditions are laid down. The classes of membership cover all types of Aeronautical experience and qualifications.

Application can be made for all classes of membership except those of Fellow and Founder Member. All applications for membership of the Society are scrutinised by the Grading Committee which is appointed by the Council to advise on membership.

All applications are made on a standard form, obtainable from the Secretary, and on this form applicants are required to give details of the examinations they have passed and full details of their training and experience. In order to assist the Grading Committee and Council in reaching a decision, applicants must give details of the positions they have held and specific details, with dates, of the work they have done. All forms must be signed by a proposer. Application forms, when completed, should be sent to the Secretary of the Society.

2. FELLOWSHIP

The highest class of membership in the Society is that of Fellow and it is the duty of the Council to see that the honour of Fellowship is awarded only to persons who have attained a high degree of technical eminence in the profession of aeronautics. A nomination for Fellowship can be initiated by a member of the Council or by any four Fellows of the Society. In this case, one of the nominating Fellows can complete an application form in the name of his nominee and this application form can then be signed by three other nominating Fellows, or any four Fellows can separately write to the Secretary nominating any person for Fellowship.

3. ASSOCIATE FELLOWSHIP

There are two ways of becoming eligible for Associate Fellowship.

Firstly, a candidate must have passed, or have obtained exemption from, the Associate Fellowship Examination. In addition he shall have had eight years experience satisfactory to the Council in the profession of aeronautics.

Full details of the examination requirements are contained in the published syllabus of the Associate Fellowship Examination.

No list of experience which would automatically be accepted is published by the Council, but applicants with experience of a type similar to that outlined below should submit their case for consideration of the Grading Committee.

(*a*) Technician engaged on research in a firm concerned with the design and development of aircraft, aero engines, their important accessories, instruments, or of fuels and lubricants for use in aircraft.

(*b*) Experimental Officer, or Scientific Officer, or equivalent, in an aircraft or aero engine research establishment.

(*c*) Flight Research Engineer responsible for experimental flight testing of aircraft or aero engines.

(*d*) Draughtsmen responsible for work in the design or project office of a firm concerned with the design and development of aircraft or aero engines.

(*e*) Technical Assistant responsible for work in the Performance, Stress, Aerodynamic or other Technical Section of a firm concerned with the design of aircraft or aero engines, their accessories or instruments.

(*f*) Senior Design Draughtsman in the Jig and Tool or Layout Office of a factory concerned with the design or production of aircraft or aero engines.

(*g*) Senior Production or Planning Engineer responsible for work of a technical nature in the production office of a factory concerned with the design of aircraft or aero engines, or their major accessories.

(*h*) Senior Inspector responsible for the accuracy of aircraft materials, aircraft assemblies, aero engines or their major accessories, provided that the candidate is applying technical knowledge to his work.

(*i*) Senior Commercial Pilot holding the necessary licences.

(*j*) Test Pilot in an aircraft or aero engine factory or research establishment concerned with prototype testing.

(*k*) Surveyor to the Air Registration Board.

(*l*) University Lecturer in Aeronautics, Lecturer in Aeronautics to a Technical College or Institute.

The By-laws do not exclude periods of training from the list of acceptable experience, although the allowance for any period of training does not cover the whole training period.

For candidates who have taken a degree in aeronautics some allowance is made, but Post-graduate work on an aeronautical subject is normally counted as experience in the profession of aeronautics.

For the second way of becoming eligible for Associate Fellowship, candidates must have fifteen years practical experience in the profession of aeronautics of a type satisfactory to the Council and must have held a position of technical responsibility for a period satisfactory to the Council. They may also be required to take Part III of the Associate Fellowship Examination.

No list of acceptable experience is published by the Council. The type of experience satisfactory to the Council under this section of the By-laws is higher than that required under the normal applications with the examination qualifications.

4. ASSOCIATESHIP

The class of Associate covers those who have experience approaching that of the Associate Fellowship standard under the examination case but who have not the full examination qualifications for Associate Fellowship. The By-laws state that Associates shall produce satisfactory evidence of their technical knowledge in the profession of aeronautics and shall have had eight years experience satisfactory to the Council in the profession of aeronautics.

The evidence of technical knowledge required by the Council varies with the experience of the candidate but the general standard is that of an apprenticeship for those working in aircraft or aero engine firms, the necessary licences for aircraft inspectors, or pilots and navigators. The purpose of this condition is to ensure that the candidate has the appropriate training for the work he is doing.

The experience required for an Associate is slightly lower than that required for an Associate Fellow in a number of cases. No list of acceptable experience is published by the Council but applicants with experience of a type similar to that outlined below should submit their case for consideration of the Grading Committee.

(*a*) Technical Assistant in the research section of a firm concerned with the design and development of aircraft or aero engines, of important materials, accessories, instruments, or of fuels and lubricants for use in aircraft.

(*b*) Draughtsman in the design or project office of a firm concerned with the design and development of aircraft or aero engines, of important materials, accessories, instruments, or of fuels and lubricants for use in aircraft.

(*c*) Technical Assistant in the Performance, Stress, Aerodynamic or other technical section of a factory concerned with the design of aircraft or aero engines, their accessories or instruments.

(*d*) Design Draughtsman in the jig and tool or layout office of a factory concerned with the design of aircraft and aero engines.

(*e*) Planning or Production engineer in the production office of a factory concerned with the design of aircraft or aero engines or their major accessories.

(*f*) Inspector responsible for the accuracy of aircraft materials, aircraft assemblies, aero engines or their major accessories, provided that the candidate is applying technical knowledge to his work.

(*g*) Foreman responsible for the production or testing of experimental aircraft or aero engines, provided that the candidate is applying technical knowledge to his work.

(*h*) Test Pilot in an aircraft or aero engine factory or research establishment.

(*i*) Senior N.C.O. in Flying Services responsible for major repairs, inspection and maintenance.

(*j*) Qualified Radio Officer in civil airline, or Signals Officer in Flying Services working in airborne or ground aircraft radio or detection.

(*k*) Instructor in navigation aircraft radio, meteorology and aeronautical engineering up to the standards required for the appropriate licences. Applicants are required to provide evidence of being qualified to perform the duties connected with their positions.

5. GRADUATES

The class of Graduate is restricted to those who are between the ages of 21 and 30 inclusive, who are engaged, or are receiving training, in the profession of aeronautics and have passed, or obtained exemption from, Parts I and II of the Associate Fellowship Examination of the Society.

6. STUDENTS

The class of Student is restricted to candidates between the ages of 18 and 28 inclusive, who are engaged in, or who intend to be engaged in, the profession of aeronautics and have passed such examinations as are accepted by the Council. The standard of the examination qualification which is required is that of an Ordinary National Certificate, School Certificate or some corresponding examination.

7. COMPANIONS

The class of Companions is restricted to those, who being ineligible for the technical grades have contributed, or are likely to contribute, to the development of aeronautical science or engineering and to the furtherance of the objects of the Society. This class contains senior executives of aeronautical firms and airlines as well as a number of people who join the Society in this class in order to keep in touch with the latest developments and to join with other members in lectures and the other facilities of the Society.

It will be seen that under the By-laws of the Society, any person interested in aeronautics can join in an appropriate class and for those who do not wish to join the main Society but are interested in aeronautics, Branches exist in many centres in this country and in the Commonwealth. Any person can join one of the Branches for a small subscription.

SECRETARY'S NEWS LETTER

DECEMBER 1951

DURING the past month I have attended two Dinner-Dances, one at Derby and the other at the Isle of Wight. Both of these functions were the first of their kind; I was informed that the ladies had been feeling rather neglected, and had practically insisted that the usual Branch Dinner become a dinner-dance. Whatever the reason for their inception, they were most enjoyable.

I arrived in Derby on 2nd November and during the afternoon was shown over the Rolls-Royce factory by Mr. A. I. Fenwick, of the Publicity Department. I learned that the "Clyde" was not named after THE CLYDE, but after some small river, flowing from the Pennines.

Mr. D. C. Smith joined me in time for the Dinner, which was held in the Rolls-Royce Canteen. Mr. A. G. Elliott was chairman and proposed the toast of the Society. The indisposition of the President was greatly regretted and, in his absence, I had the pleasure of replying to the toast. Other speeches were given by Mr. F. Nixon and Wing Commander Roxburgh. After the speeches the dining room became the dance hall; at the smallest hour the dance became an enjoyable memory.

On 7th November I went to the Weybridge Branch to hear the lecture by Air Commodore H. Satterly on "Bombers from the Operators' Point of View." The discussion which followed proved lively and interesting. The lecture was followed by a dinner given by the Branch President, Mr. G. R. Edwards. Among those present were Sir Hew Kilner, Mr. H. H. Gardner (the Branch Chairman), Mr. J. Sinclair (the Honorary Secretary) and members of the staff of Vickers.

During the following morning, under the guidance of Mr. "Jock" Sinclair, I saw something of the educational side of Vickers.

For their Reception on 9th November at 4 Hamilton Place, the Graduates and Students produced a programme which was very well done. There was dancing in the Library and films in the Council Room. It was a good function, perhaps a little lacking in gaiety at first, but by the end it had warmed up considerably. Mr. J. G. Roxburgh and his Committee are to be congratulated on its success.

At the invitation of Mr. F. T. Meacock, the Chairman of the de Havilland Technical School Old Boys' Association, I was present at their first Annual Dinner, held in Simpson's in the Strand. Among the guests was C. G. Grey, who was in reminiscent mood, and his "I remember" stories caused no little hilarity.

I had never been in Somerset until I visited the Yeovil Branch on 15th November. Air Marshal Sir Robert Saundby gave an interesting lecture on "The Role of Aircraft in Future Warfare." Equally interesting was the discussion at dinner on railway engines, upon which Sir Robert is an expert. Indeed, the Chairman, Mr. E. C. Wheeldon, suggested that Railways might be the subject of a future lecture by Sir Robert.

Mr. D. C. Smith and I stayed over-night at the Westland Guest House and next morning visited the Westland factory. We were particularly interested in the Westland Sikorsky Helicopter, the S55, and in its potentialities. Mr. L. A. Lansdown, the Branch Secretary, took us to Normalair Ltd., where Commander Bassett showed us over the factory.

In the absence of the President, Major Bulman took the chair at the Main Society Lecture at Cheltenham on 22nd November. The lecture, "Problems of Transonic Flight," by Mr. A. N. Clifton, of Vickers-Armstrongs (Supermarine), was very well

attended. There were more than 420 present; at least seven Branches were represented, including the Gloucester and Cheltenham Branch, and there was a large number from the Royal Aircraft Establishment, Farnborough. After the lecture, Mr. Dowty, the Branch President, gave a dinner at the Queens Hotel; among the guests were representatives of the various Branches.

During the following morning I accompanied Mr. Clifton to Hursley Park and was shown over the various departments of Vickers-Armstrongs (Supermarine). I find test rigs and research laboratories very interesting, and those at Vickers-Armstrongs (Supermarine) were no exception.

From Southampton I went across to the Isle of Wight at the invitation of the Branch there. Before the dinner-dance I managed to sandwich in a few hours looking over the "Princess" flying boat at Saunders-Roe. I shall not make any comment on this giantess for the Press commented upon it on its recent removal from the hangar. The "Princess" is impressive—a wing float looks like the fuselage of a small aircraft.

Among the guests were Captain and Mrs. Laurence Pritchard, and Miss Barwood and Miss Voyce, of the Society Staff. In the absence of the Branch President, Mr. Knowler, on account of illness, Mr. Browning acted as Chairman at the Dinner. Mr. Crewe proposed the toast of the guests. It was pleasing to note that he had read his JOURNAL, whence he had gleaned many facts, used in his speech.

The function was very successful, and I should like to convey to the Branch members the thanks of the two ladies of the Staff and myself for the kind invitation.

I have now visited seven Branches; each and every one appears to be flourishing and enthusiastic. The lectures at which I have been present have been well attended, and the discussions good.

Some Graduates are perturbed about the age limit in By-Law 7 (*a*), which is: "He shall be twenty-one years of age or over, but shall be not more than thirty years of age (except in such cases as the Council may determine)."

I wish to emphasise the last phrase; this means that the Council will consider an extension of the age limit in individual cases. As long as there is compulsory National Service it is probable that not a few Graduates will have reached the age of 30 years before they have had the eight years experience necessary for Associate Fellowship.

Mr. W. Isbister, the Secretary of the Australian Division is in this country at present, it was pleasant to welcome him at the Society and to have an opportunity to discuss the Australian Division with him.

Beginning with the January JOURNAL the Secretary's News Letter and the Monthly Notices of the Society are to be bound with the JOURNAL—as was done some years ago. Those Associate Members who do not receive the JOURNAL will continue to receive their News Letter and Notices.

The President, Major F. Halford, continues to make progress. He has had eight weeks treatment and is hopeful that he will be with us again early in 1952.

A. M. Ballantyne

Secretary

NOTICES

CHRISTMAS 1951

The President, Major F. B. Halford, the Council, and the Staff of the Society wish all members, at home and overseas, a Merry Christmas and a Happy New Year.

CHRISTMAS HOLIDAYS

The Library and Offices of the Society will be closed from 5 p.m. on Friday 21st December until Thursday 27th December at 9 a.m.

CONTENTS OF THE DECEMBER JOURNAL

Supersonic Propellers, W. F. Hilton, Ph.D., A.F.R.Ae.S.
Instrumentation for Testing Aircraft and Aero-Engines, C. N. Jaques, B.Sc., A.F.R.Ae.S.
Summary of the Activities of the Society for 1951.
Reviews. Correspondence.
Index to Volume LV 1951.

THE AERONAUTICAL QUARTERLY—Part III, Volume III

Part III, November 1951 of the Aeronautical Quarterly will be available towards the end of December. The Contents of Part III, Volume III are:—

Photoelasticity and Aircraft Design	H. T. Jessop and C. Snell
A Note on the Design of Ducted Fans	B. Thwaites
A New Treatment of the Tuned Absorber with Damping ...	D. C. Johnson
A New Approach to Thin Aerofoil Theory	M. J. Lighthill
The Profile Drag of Yawed Wings of Infinite Span ...	A. D. Young and T. B. Booth
Beams on Cross-Girders with Clamped Ends	J. M. Klitchieff
A Direct Aerodynamic Proof of the Biot-Savart Law ...	J. Lockwood Taylor

Copies of Volume III, Parts I and II, are still available from the offices of the Society at 7s. 9d. a copy to members of the Society, post paid, or 10s. 3d. to non-members, post paid.

MEMBERS' NEW APPOINTMENTS

C. CHAPLEO (*Fellow*), formerly of the Royal Aircraft Establishment, has joined the Airspeed Division of the de Havilland Aircraft Co. Ltd., and will be in charge of the stress and structural test departments at Christchurch.

P. G. DUFF (*Associate Fellow*), has been appointed Engineer-in-Charge of Industrial Production Equipment and Land Transport Equipment Section, Ministry of Munitions.

DR. M. HOLT (*Fellow*) is leaving the Department of Mathematics, University of Sheffield, to take up a new appointment on 1st January 1952 as Principal Scientific Officer, Armament Research Establishment, Fort Halstead, Sevenoaks.

C. B. V. NEILSON (*Associate Fellow*) has been appointed Technical Director, Electro-Hydraulics Ltd.

N. A. WHITE (*Associate Fellow*) has been appointed Asssistant Manager of the Technical Department of Shell Co. of Philippine Islands Ltd.

RECENT AWARDS TO MEMBERS

The Gold Medal for 1950-51 of the Institute of Navigation has been awarded to H. C. Pritchard, *Fellow*, for valuable contributions in the field of airborne navigation.

The Kelvin Medal 1950 was presented to Dr. Theodore von Kármán, *Hon. Fellow*, of the California Institute of Technology, by the Institution of Civil Engineers, on Tuesday 6th November 1951.

Professor J. C. Hunsaker, *Hon. Fellow*, has been awarded the Wright Brothers Memorial Trophy for 1951 for "significant public service of enduring value to aviation."

FORTIETH WILBUR WRIGHT MEMORIAL LECTURE 1952

The Fortieth Wilbur Wright Memorial Lecture will be given by Sir Harrry M. Garner, C.B., M.A., F.R.Ae.S., Chief Scientist to the Ministry of Supply, in May 1952. The title of this lecture will be announced later.

ASSOCIATE FELLOWSHIP EXAMINATION—DECEMBER 1951

The next Associate Fellowship examination will be held on 18th, 19th and 20th December 1951 in the offices of the Society. The Library will be closed to members on those days. All candidates have been sent a timetable and full particulars of the examination.

FIFTH LOUIS BLERIOT LECTURE, PARIS 1952

The Fifth Louis Bleriot Lecture will be given by H. Knowler, A.M.I.C.E., F.R.Ae.S., Director and Chief Designer, Saunders-Roe Ltd. The Lecture will be given in Paris on 12th March 1952 on "The Future of the Flying Boat."

PHOTOGRAPHS OF MEMBERS

A number of photographs of members and guests were taken during the Anglo-American Aeronautical Conference in Brighton in September and at the Reception at 4 Hamilton Place, following the Wilbur Wright Memorial Lecture on 10th September. A complete set is available in the offices of the Society and members may inspect them at any time so that they may order any copies they require.

COMMITTEE MEETINGS HELD IN NOVEMBER

A Meeting of Council was held on 29th November. Among the items discussed were the Report of the Future Policy Committee; Report of the Finance Committee; Report of the Grading Committee; Report of the Branches Committee; Liaison with other Societies.

During November eight meetings were held by Committees of the Society. Outside bodies engaged in aircraft engineering and research held 23 meetings in the offices of the Society.

MEMBERSHIP OF THE HELICOPTER ASSOCIATION OF GREAT BRITAIN

The Council of the Helicopter Association of Great Britain has decided that full membership of the Association shall be open to Associate Fellows of the Royal Aeronautical Society, provided that such candidates at the time of application are actively engaged in the execution, or administration, of rotary wing activities, including research, design, development, production and operation. Previously a definite qualifying period of experience in the rotary wing field was required for full membership for otherwise suitably qualified candidates.

EIGHTH INTERNATIONAL CONGRESS ON THEORETICAL AND APPLIED MECHANICS

The Eighth International Congress on Theoretical and Applied Mechanics will be held in Istanbul, Turkey, from 20th to 28th August 1952. Membership of the Congress will be open to all qualified persons whether they are able to be present in Istanbul or not. For regular members of the Congress the fee is $10.00, which entitles them to participate in all the Scientific and Social features of the Congress and to contribute papers.

The Sections for the presentation of short contributed papers will be:—

Section I: Elasticity—Plasticity—Rheology.
Section II: Fluid Mechanics (Aerodynamics—Hydrodynamics).
Section III: Mechanics of Solids (Ballistics — Vibrations — Friction — Lubrication).
Section IV: Statistical Mechanics—Thermodynamics—Heat Transfer.
Section V: Mathematics of Physics and Mechanics—Methods of Computation.

Full particulars of the Congress may be obtained from the Chairman of the Organising Committee, Dr. Kerim Irim, The Eighth International Congress for Theoretical and Applied Mechanics, P.O. Box 245, Istanbul, Turkey.

MAIN LECTURES

(At 6 p.m. in the Lecture Hall of the Institution of Civil Engineers, Great George Street, London, S.W.1, unless otherwise stated. Tea will be served at 5.30 p.m.)

Thursday, 20th December 1951—Control Surface Flutter, E. G. Broadbent, A.F.R.Ae.S., and W. T. Kirkby, A.F.R.Ae.S.—*at the Institution of Mechanical Engineers, Storeys Gate, S.W.1.*

Thursday, 7th February 1952—The Availability and Use of Aeronautical Information—A joint discussion with the Aeronautical Information Group of A.S.L.I.B.

SECTION LECTURE

(*At 7 p.m. in the Library of the Royal Aeronautical Society, 4 Hamilton Place, London, W.1*)

Thursday, 31st January 1952—The Problem of Short Haul Air Travel, P. Brookes, A.F.R.Ae.S.

GRADUATES' AND STUDENTS' SECTION

LECTURE

(*At 7.30 p.m. in the Library of the Royal Aeronautical Society, 4 Hamilton Place, London, W.1*)

Tuesday, 22nd January 1952—Aircraft and Agriculture, P. H. Southwell.

BRANCH NOTICES

BRISTOL BRANCH

Tuesday, 18th December 1951—Aeronautical Brains Trust. Question Master: N. E. Rowe, C.B.E., D.I.C., B.Sc., A.C.G.I., F.R.Ae.S.

Wednesday, 2nd January 1952—The Influence of Metallographic Structure on Fatigue, Major P. L. Teed, F.R.Ae.S., M.Inst.Met., M.I.M.M., F.Phys.S. (Section Lecture).

Tuesday, 8th January 1952—Airframe Fatigue, H. H. Gardner, B.Sc., F.R.Ae.S. (Section Lecture).

Monday, 14th January 1952—Fatigue—Its Effect on Engine Design, K. Chamberlain, B.Sc., A.M.I.Mech.E., A.F.R.Ae.S. (Section Lecture).

Wednesday, 23rd January 1952—Flight Refuelling, C. H. Latimer-Needham, M.Sc., F.R.Ae.S., F.Z.S., M.S.A.E.

Monday, 11th February 1952—The Design of a Jet Engine, A. A. Lombard, A.F.R.Ae.S.

Tuesday, 26th February 1952—The Campaign Against Terrorism in Malaya, Air Vice-Marshal Sir Francis J. W. Mellersh, K.B.E., A.F.C., M.A.

Tuesday, 22nd April 1952—Annual General Meeting and FILM SHOW.

In the Conference Room, Filton House, Bristol Aeroplane Co., at 6 p.m.

BROUGH BRANCH

Wednesday, 12th December 1951—Thirty Years of Naval Aircraft Development, G. E. Petty, F.R.Ae.S., M.I.Mech.E.

Wednesday, 23rd January 1952—Planning and Production Methods used in the Construction of the "Comet" Aircraft, H. Povey, A.F.R.Ae.S.

Thursday, 21st February 1952—MAIN SOCIETY LECTURE.

Wednesday, 19th March 1952—A Talk on Airships, Rt. Hon. Lord Ventry.

Wednesday, 23rd April 1952—The Testing of Experimental Aircraft, Lieut. R. H. Reynolds, D.S.C., A.F.C., R.N.

In the Lecture Hall, Electricity Showrooms, Ferensway, Hull, at 7.30 p.m. Admission is by ticket only.

CHESTER BRANCH

Tuesday, 8th January 1952—Combustion Problems of Aircraft Propulsion, S. Allen, A.F.R.Ae.S., M.I.Mech.E. (*Joint meeting with the Institute of Petroleum, Stanlow Branch*).

Wednesday, 6th February 1952—Members' Lectures.

Tuesday, 4th March 1952—Synthetic Adhesives, by a representative of Aero Research Limited.

Wednesday, 2nd April 1952—Flight Refuelling, C. H. Latimer-Needham, M.Sc., F.R.Ae.S., F.Z.S., M.S.A.E.
Wednesday, 14th May 1952—Annual General Meeting.
At the Grosvenor Hotel, at 7.30 p.m.

COVENTRY BRANCH

Wednesday, 19th December 1951—FILM Evening.
Wednesday, 16th January 1952—Rocket Propelled Missiles, W. H. Stephens.
Wednesday, 20th February 1952—Parachutes, J. E. Hatfield.
Wednesday, 23rd April 1952—Annual General Meeting and FILMS.
In the Wine Lodge (Corner of Corporation Street and The Burges) at 7.30 p.m.

DERBY BRANCH

Monday, 7th January 1952—Canberra Flight Testing, Wing Cdr. R. P. Beamont, D.S.O., D.F.C.
Monday, 4th February 1952—Airships, Lord Ventry.
Monday, 3rd March 1952—Present and Future Trends in Air Line Operation, H. W. Seagrim, Director of Operations, Trans-Canada Airways.
Monday, 7th April 1952—Flying Boats, H. Knowler, F.R.Ae.S.
Monday, 5th May 1952—Wind Tunnels, F. B. Greatrex, B.A., A.M.I.E.E., A.F.R.Ae.S.
In the Rolls-Royce Welfare Hall, Nightingale Road, at 6.15 p.m.

GLOUCESTER AND CHELTENHAM

Wednesday, 12th December 1951 (*Gloucester*)—The Effect of Jet Engines on Aircraft Design, H. W. V. Steventon, M.I.Mech.E., A.F.R.Ae.S.
Thursday, 10th January 1952—*Cheltenham*—Structural Experiments, Professor A. G. Pugsley, O.B.E., D.Sc., F.R.Ae.S.
Wednesday, 30th January 1952—*Gloucester*—Turbo-Props, E. Danvers.
Thursday, 28th February 1952—*Cheltenham*—The Development of the Aircraft Gas Turbine in Great Britain and its Influence on Petroleum Requirements, K. C. Hunt, B.Sc., A.C.G.I., A.F.R.Ae.S., F.I.P., A.M.I.Mech.E.
Wednesday, 26th March 1952—*Gloucester*—Some Aspects of High Performance Jet Aircraft, Sqdn. Ldr. W. A. Waterton, A.F.C. and Bar.
Thursday, 24th April 1952—*Cheltenham*—Annual General Meeting.
Gloucester Meetings are held in the Wheatstone Hall, City Library, Brunswick Road, at 7.30 p.m.
Cheltenham Meetings are held in the Assembly Hall, St. Mary's College, at 7.30 p.m.

ISLE OF WIGHT BRANCH

Thursday, 13th December 1951—Annual General Meeting and FILMS. (Hydrodynamic Development, by the Consolidated Vultee Aircraft Corp.)
Thursday, 17th January 1952—Metal Adhesive Processes, F. H. Parker.
Thursday, 31st January 1952—Electronics, P. Jackson.
Thursday, 14th February 1952—Welded Magnesium Aircraft Components, R. J. Cross.
Thursday, 28th February 1952—Radio and Radar Navigational Aids, H. C. Hinckley.
Thursday, 13th March 1952—The Princess, H. Knowler, A.M.I.C.E., F.R.Ae.S.
Thursday, 27th March 1952—Junior Prize Lectures.

MANCHESTER BRANCH

Thursday, 13th December 1951—The Dart Engine, A. D. Jackson, A.F.R.Ae.S.
Thursday, 17th January 1952—Power Controls, D. J. Millard.
Wednesday, 13th February 1952—Problems of Servicing Modern Aircraft, Group Captain G. M. Buxton, O.B.E.
Thursday, 13th March 1952—The Problems in the Design of Wheels, J. Wright.

In the Reynolds Hall, College of Technology, Manchester, at 7.30 p.m.

PORTSMOUTH BRANCH

Thursday, 20th December 1951—FILMS: Flight Six; West Wind; The Gates of Power; New Town; and Contribution to Victory.
Thursday, 3rd January 1952—The Development and Production of the Comet Air Liner, H. Povey, A.F.R.Ae.S.
Thursday, 17th January 1952—FILMS: Berlin Airlift; Shipbusters; Clydebuilt; World Garden; and Colonel Crompton—Pioneer and Prophet.
Thursday, 31st January 1952—Airline Operating Problems, Peter G. Masefield, M.A., F.R.Ae.S.
Thursday, 14th February 1952—FILMS: Power Lines; In all Weathers—Radar for Merchant Shipping; From Silkworm to Parachute; Glass Blowers of England; and A Glimpse of Metrovick.
Thursday, 28th February 1952—Rocket Propulsion—the Prospects for Inter-Planetary Flight, J. Humphries, A.F.R.Ae.S.
Thursday, 13th March 1952—FILMS: Houses in History; Gems of the Rockies; This is Britain; and Turbo Jet Propulsion.
Thursday, 27th March 1952—Annual General Meeting.

At Airspeed Ltd., The Airport, Portsmouth, at 6 p.m.

SOUTHAMPTON BRANCH

Wednesday, 16th January 1952—The Korean Campaign, W. Courtenay, O.B.E., M.M., A.R.Ae.S.
Wednesday, 20th February 1952—An Introduction to Supersonics, C. H. E. Warren, M.A.
Wednesday, 19th March 1952—Development of the Viscount, G. R. Edwards, M.B.E., B.Sc., F.R.Ae.S., A.M.I.Struct.E.
Wednesday, 9th April 1952—Wind-Excited Oscillations of Suspension Bridges, C. Scruton, B.Sc. (*A Joint Meeting with Southern Branches of the Institution of Mechanical Engineers and the Institution of Civil Engineers*).

In the Physics Lecture Theatre, University College, Southampton, at 7 p.m.

WEYBRIDGE BRANCH

Wednesday, 12th December 1951—Brains Trust: Air Vice-Marshal G. W. Tuttle, C.B., O.B.E., D.F.C., A. A. Hall, M.A., F.R.Ae.S., Charles Gardner, O.B.E., A.R.Ae.S., G. R. Edwards, M.B.E., B.Sc., F.R.Ae.S., A.M.I.Struct.E.
Friday, 28th December 1951—ANNUAL DANCE—*St. George's Hill Tennis Club.*
Wednesday, 9th January 1952—Modern Aircraft, G. R. Edwards, M.B.E., B.Sc., F.R.Ae.S., A.M.I.Struct.E.
Wednesday, 30th January 1952—Junior Prize Lecture. Branch Members.
Wednesday, 20th February 1952—Flight Testing from the Pilots Angle, Wing Commander T. Balmforth, D.S.O., D.F.C.
Wednesday, 12th March 1952—Planning and Aircraft Development, F. Olaf Thornton, A.F.R.Ae.S.
Wednesday, 2nd April 1952—Why a Delta? S. D. Davies, B.Sc., F.R.Ae.S.
Wednesday, 16th April 1952—FILM SHOW.
Wednesday, 14th May 1952—Annual General Meeting.

At Vickers-Armstrongs Ltd., Weybridge, at 6 p.m.

YEOVIL BRANCH

Wednesday, 12th December 1951—Local Railway Systems, A. Osborne, and a FILM—Helicopter Aerobatics.
Thursday, 17th January 1952—FILM: High Speed Hydrodynamic Research.
Thursday, 21st February 1952—The Giant Helicopter, O. O. Fitzwilliams.
Thursday, 20th March 1952—Technical Brains Trust.
Friday, 4th April 1952—Annual General Meeting.

ELECTIONS

The following is a list of new members and transfers of membership of the Society:—

Associate Fellows

Jack Anstess
Frederick Ecton Barnes
Gordon Desmond Bateman (from Graduate)
Robert George Bowditch
Jack Bunting
Jean Marie Rene Brogard
David Mark Cockburn
Gavin Fleming Davidson
Frederick John Davison (from Graduate)
Stanley Gray (from Graduate)
Arthur Francis Houghton (from Graduate)
Richard Watson McKay (from Associate)
John Nash (from Associate)
Herbert Wilfred Rigby
Peter Rivers (from Graduate)
Ralph Lovell Edwin Toms (from Graduate)
Denis Frederick William Woor (from Associate)

Associates

Eddardo A. Borgna
Fred Brookes
Frank Douglas Bush
Edward James Cashman
William Edward Hagan
William Francis Hill
Ivan Beresford Holmes
Frederick Avann Mason (from Student)
Leonard Martin Pankhurst
Harry William Smith
Hugh Renus Sutherland
Douglas Cyril Tritton
Charles Victor George Usher
Alfred Williams

Graduates

Aldric B. Au-Yong
Andrew Fyfe Duncan (from Student)
George Kenneth Frank Green (from Student)
Alan Sidney Henney (ex-Student)
Frederick Arthur Hewitt (from Student)
Richard Godfrey Palgrave Hood (from Student)
Philip Reed Miller (from Student)
Robin Salmon
Derrick Francis Simpson
George Edward Whitmarsh

Students

Norman Birch
John Thornton Clarke
Michael John Patmore Cowper
Thomas Patrick Doherty (from Graduate)
Donald John Leech
Eric James Phillips
Gilbert Joseph Rothery
Ivor Harold Smart
Edward Clement Weston

Companions

George Walter Dandridge
John Norman Dean
Albert Geoffrey Griffiths (ex-Graduate)
Peter Douglas Dorcenne Bois Rowland

ACKNOWLEDGMENTS

The President and Council wish to acknowledge with grateful thanks a collection of historical slides presented by W. H. Brodey, Esq., Director of the North Bar Tool Co.; and a Farman catalogue presented by Air Commodore E. A. Masterman, C.B., C.M.G., C.B.E., A.F.C.

They also acknowledge with thanks the return of back numbers of the JOURNAL from P. H. Watson, Esq., *Associate Fellow*.

JOURNAL BINDING

The attention of members is drawn to a special leaflet on JOURNAL binding for the 1951 Volume and for 1952, which is enclosed with the December JOURNAL, or with these Notices.

ANNUAL SUBSCRIPTIONS

Members are reminded that their annual subscriptions become due on 1st January 1952. The rates are:—

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* Any Associate elected before 1st October 1947 may, if he wishes, elect not to receive the JOURNAL, and in this case his subscription will be reduced by £1 1s. 0d. to £2 2s. 0d.

It will avoid delay and confusion if members, when sending remittances for subscriptions, will state their names clearly and give their addresses and grades of membership.

Remittances should be made payable to the Royal Aeronautical Society.

CHANGES OF ADDRESS

To assist in keeping the records of members correct and up to date the Secretary will be glad if all members will notify him as soon as possible of changes of address.

When notifying changes please give the following particulars:—

Name (in block letters).
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Old address.

Changes of address must be received *before the 15th of the month* in order to be effective for the JOURNAL for the following month.

ADDITIONS TO THE LIBRARY

The following have been added to the Library (titles of pamphlets are printed in italics; books marked * or ** may not be taken out on loan):—

Bailey, S. F. and L. M. Smith	Handbook of Agricultural Pest Control. Industry Publications. 1951.
Bergin, K. G.	Immunization and Air Travel. Reprint from "The Practitioner." 1951.
Civil Aeronautics Administration, U.S.A.	Flight Instruction Manual. U.S.G.P.O. 1951.
Civil Aeronautics Administration, U.S.A.	Standard Specifications for Construction of Airports. U.S.G.P.O. 1948.

Clark, D. A. R.	Advanced Strength of Materials. Blackie. 1951.
Crede, C. E.	Vibration and Shock Isolation. Wiley. 1951.
Fisher, J. W.	*Photography at Sea of Ship Propeller Cavitation. N.E. Coast Inst. Eng. and Ship. 1951.*
Innes, H.	Air Bridge. Collins. 1951.
Marbarger, J. P.	Space Medicine. University of Illinois. 1951.
Murray, W. M. (Ed.)	Proceedings of the Society for Experimental Stress Analysis. Volume IX, Part 1. 1951.
Neurath, M.	Rockets and Jets (A Children's Book). Parrish. 1951.
Spiral Tube & Components Co. Ltd.	Finned Tube. 1951.
Smith, H. M., A. J. Kraemer and H. M. Thorne	Aviation Gasoline and its Component Hydrocarbons. U.S.G.P.O. 1951.
Teare, D.	*Post Mortem Examinations on Air-Crash Victims. Reprint B.M.J. 1951.*
Tendler, M. and F. M. Holz (Eds.)	Official Airline Route and Mileage Manual. Traffic and Service Corp. 1951.
U.S.A.F.-Navy-Commerce	Design of Wood Aircraft Structures. U.S.G.P.O. 1951.
U.S.A.F.-Navy-Commerce	Sandwich Construction for Aircraft. Part II. U.S.G.P.O. 1951.
U.S. Naval Air Technical Training Command	Aircraft Hydraulics. U.S.G.P.O. 1951.

Aeronautical Research Council. Reports and Memoranda

2249—*The effect of the condensation of atmospheric water vapour on total head and other measurements in the N.P.L. high speed tunnels. H. H. Pearcey. Note on the interpretation of readings of Pitot and static tubes in a high speed tunnel in which condensation of moisture is taking place. C. N. H. Lock.*

2402—*Parachute Design. T. F. Johns.*

2444—*Expressions for the rates of change of critical flutter speeds and frequencies with inertial, aerodynamic and elastic coefficients. G. H. L. Buxton and I. T. Minhinnick.*

2504—*High speed wind tunnel tests on models of two jet-propelled fighters (Meteor and Vampire). R.A.E. Staff.*

2564—*Measurement of aircraft attitude relative to flight path during dives. J. E. H. Braydon.*

National Aeronautical Establishment, Canada. Laboratory Reports

LR-2—*A study of wing torsional divergence. T. J. Mentel.*

LR-3—*Orifice-type ice detector: preliminary icing tunnel tests of functioning as ice detector, rate-of-icing meter, and icing-severity meter. D. Fraser.*

LR-5—*The effect of surface active agents on petroleum fuels. F. G. Kitson.*

National Research Council of Canada. Aeronautical Report

AR-9—*Experimental diagrams of deformation and strain distribution in curved plates under compression. K. B. Jackson and A. H. Hall.*

Publications Scientifiques et Techniques du Ministère de L'Air, France

Note Technique No. 43—*Les aspects fondamentaux de la thermocinétique. P. Vernotte.*

National Luchtvaartlaboratorium, Amsterdam, Holland. (In English)

Report F.86—*Ternary wing bending-aileron-tab flutter. A. I. van de Vooren and D. J. Hofsommer.*

Report S.374—*Study on the frequency of gust loads. J. P. Benthem.*

The Aeronautical Research Institute of Sweden. Reports. (In English)

39—*Apparatus for recording the compressive stress-strain curve for thin material coupons at large strains. B. Bergovist.*

40—*Note on wall interference in two-dimensional flow at subsonic and transonic speeds. G. Drougge.*

41—*The induced sidewind behind swept wings at subsonic velocities. W. Jacobs.*

National Advisory Committee for Aeronautics, U.S.A.

Reports

1001—*Fundamental effects of aging on creep properties of solution-treated low-carbon N-155 alloy. D. N. Frey, J. W. Freeman and A. E. White.*

1002—*On the theory of oscillating airfoils of finite span in subsonic compressible flow. E. Reissner.*

1003—*Correlation of physical properties with molecular structure for some dicyclic hydrocarbons having high thermal-energy release per unit volume. P. H. Wise, K. T. Serijan and I. A. Goodman.*

1004—*A lift-cancellation technique in linearised supersonic-wing theory. H. Mirels.*

1005—*Analytical determination of coupled bending-torsion vibrations of cantilever beams by means of station functions. A. Mendelson and S. Gendler.*

1006—*Analysis of thrust augmentation of turbojet engines by water injection at compressor inlet including charts for calculating compression processes with water injection. E. C. Wilcox and A. M. Trout.*

Technical Memoranda

1290—*The structure of Airy's stress function in multiply connected regions. G. Grioli.*

1293—*Approximate method of integration of laminar boundary layer in incompressible fluid. L. G. Loitsianskii.*

1301—*The flow of gases in narrow channels. R. E. H. Rasmussen.*

1302—*Stability of the cylindrical shell of variable curvature. K. Marguerre.*

1303—*Resistance of cascade of airfoils in gas stream at subsonic velocity. L. G. Loitsianskii.*

1304—*Generalisation of Joukowski formula to an airfoil of a cascade in compressible gas stream with subsonic velocities. L. G. Loitsianskii.*

1306—*Three papers from conference on "wing and tail-surface oscillations"—6th-8th March 1941, Munich. H. Söhngen, L. Schwarz and F. Dietze.*

1307—*Lateral control by spoilers at the DVL. M. Krama, Th. Zobel and C. G. Esche.*

1313—*On the recording of turbulent longitudinal and transverse fluctuations. H. Reichardt.*

Technical Notes

2404—*An analytical investigation of effect of high-lift flaps on take-off of light airplanes. F. E. Weick, L. E. Flanagan, Jr. and H. H. Cherry.*

2424—*Flight investigation of the effect of transient wing response on wing strains of a twin-engine transport airplane in rough air. H. C. Mickleboro and C. C. Shufflebarger.*

2425—*Plastic stress-strain relation for 75S-T6 aluminum alloy subjected to biaxial tensile stresses. J. Marin, B. H. Ulrich and W. P. Hughes.*

2426—*An investigation of aircraft heaters. XXXIV—Experimental determination of thermal and hydrodynamical behaviour of air flowing between a flat and a wave-shaped plate. L. M. K. Boelter, V. D. Sanders, G. Young, M. Morgan and E. H. Morrin.*

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2428—*An investigation of aircraft heaters. XXXVI—Preliminary investigation of a combustion-type aircraft heater. L. M. K. Boelter, W. R. Elswick, V. D. Sanders and M. W. Rubesin.*

2430—*Synthesis, purification and physical properties of hydrocarbons of the naphthalene series. I—l-methylnaphthalene, l-ethylnaphthalene, l-butylnaphthalene, l-ethylnaphthalene, l-butylnaphthalene, and l-isobutylnaphthalene. H. F. Hipsher and P. H. Wise.*

2431—*Skin friction of incompressible turbulent boundary layers under adverse pressure gradients. F. R. Goldschmied.*

2432—*Transformations of the hodograph flow equation and the introduction of two generalised potential functions. L. Crocco.*

2433—*A critical review of notch sensivity in stress-rupture tests. W. F. Brown, Jr., and G. Sachs.*

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2436—*Heat delivery in a compressible flow and applications to hot-wire anemometry. Chan-Mou Tchen.*

2437—*Some measurements of the effect of gaseous imperfections on the critical pressure ratio in air and the speed of sound in nitrogen. C. du P. Donaldson and J. J. Jones.*

2438—*Heat transfer to bodies in a high-speed rarefied-gas stream. J. R. Stalder, G. Goodwin and M. O. Creager.*

2439—*A theory of conductivity of cold-worked copper. R. Landauer.*

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